Heating Piping & Air Conditioning

DESIGN
INSTALLATION
OPERATION
MAINTENANCE

AUGUST ★ 1952

INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

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FOR CLASSY SHOPS

. . . OR BUSY PLANTS

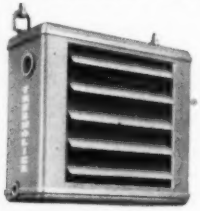
THERMOLIER UNIT HEATERS

The condensed table below is a quick guide to the selection of the correct Thermolier for specific conditions. The capacities, when motors are operating at normal speeds, are based on Standard Basis of Rating: 2 lb. steam pressure and 60° F entering air temperature.

Grinnell Thermoliers are tested and they are rated in strict accordance with rules of the Industrial Unit Heaters Association.

All Thermoliers can be operated at working steam pressures up to 125 psi and steam temp. up to 406° F.

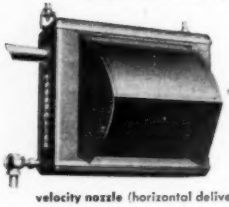
A MODEL AND SIZE FOR EVERY PURPOSE



horizontal delivery

textile (horizontal delivery)

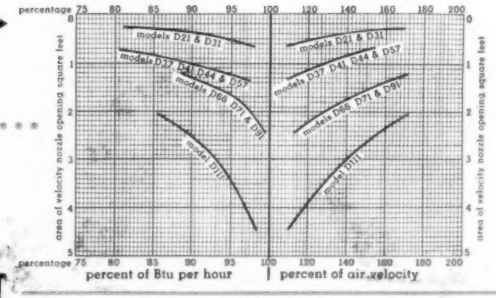
vertical delivery



velocity nozzle (horizontal delivery)

model	total heat delivered, Btu per hr	sq ft edr (nominal)	air velocity at exit, louvers open, lin. ft. per min.
horizontal delivery			
D21	35,600	148	786
D31	48,700	203	851
D37	62,200	259	753
D41	71,000	295	901
D44	84,100	350	887
D57	101,300	422	1016
D66	128,700	536	779
D71	151,700	632	977
D91	196,000	817	985
D111	275,300	1147	1048
Textile			
TX70	69,800	291	826
TX110	113,700	474	877
vertical delivery			
VA1042	50,800	212	1399
VA1045	73,600	307	1287
VA1065	109,400	456	1354
VA1075	145,600	607	1231
VA1101	185,000	770	1495
VA1111	257,000	1071	1631

performance with velocity nozzle ▶


percentage 75 80 85 90 95 100 120 140 160 180 200
models D21 & D31
models D37, D41, D44 & D57
models D66, D71 & D91
model D111
models D21 & D31
models D37, D41, D44 & D57
models D66, D71 & D91
model D111
area of velocity nozzle opening square feet
percent of Btu per hour
percent of air velocity

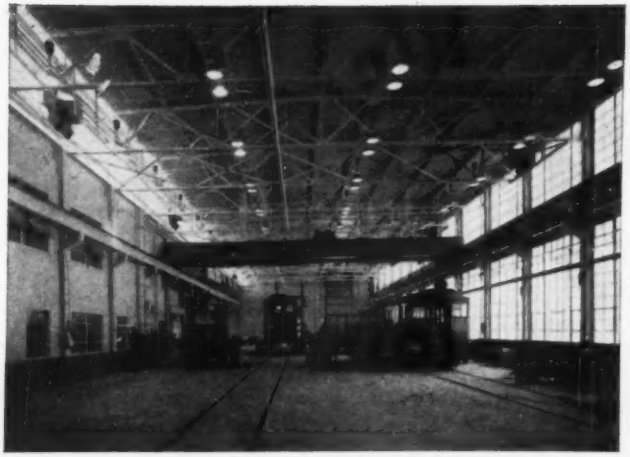
GRINNELL

THERMOLIER UNIT HEATERS

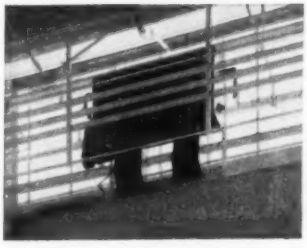
CALL YOUR LOCAL GRINNELL DISTRIBUTOR

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports
Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems



25 Blower Type Unit Heaters Service New Boston Transit Repair Shop



Suspended Blower Heaters, inverted type with cowls and deflector grilles, prove effective in this Boston building. Each heater includes sections containing two centrifugal blowers and steam coil. Blower heater capacity is 3,600 cfm, and produces 120,000 to 205,000 BTU's per hour per unit. Heaters are mounted 27 ft. from the floor because of the traveling crane.

The interior of the new Metropolitan Transit Authority Repair Shop presented a problem in heating because of the unusually vast amount of space. To successfully meet this problem, Crane Plumbing & Heating Company installed 25 usAIRco Blower Type Unit Heaters, BH 210. These powerful blower heaters provide large volumes of uniform heat to keep the M. T. A. Repair Shop at a constant, comfortable temperature.

usAIRco Blower Unit Heaters are built in 8 sizes, with arrangements for floor, ceiling, wall or inverted wall mounting; with hot water, steam, or steam distributing coils. Units are especially effective in heating factories, garages, foundries and warehouses . . . wherever extremely large areas require even heat.

See your nearest usAIRco agent or write to Dept. HP 852

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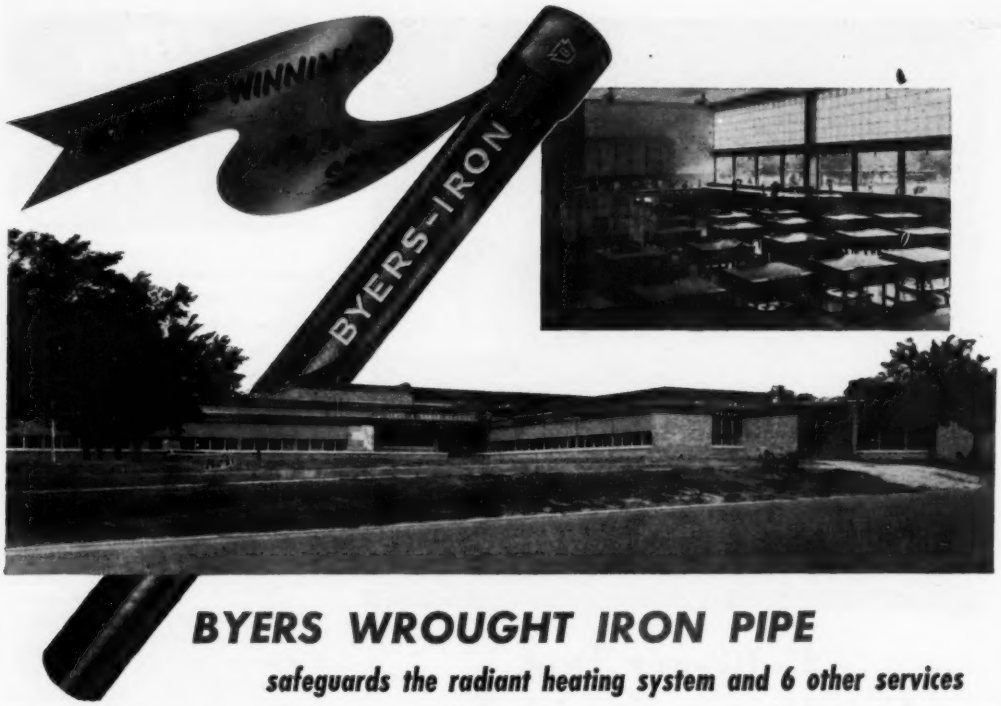

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safeguards the radiant heating system and 6 other services

Selected by the American Association of School Administrators as one of the best modern rural school designs, the Lincoln Grade and Junior High School, Lincoln, Kansas, represents an outstanding example of functional architecture and material selection.

Arranged to serve community and students with equal comfort and efficiency, the $320,000 structure features a radiant heating system augmented by a duct system that introduces tempered fresh air into the classrooms. In addition to the over-all comfort provided by the system, the lower-aged children playing on the floor are protected from hazardous drafts. To assure permanence and freedom from maintenance, the designers specified genuine wrought iron for the radiant heating coils. This time-tested material was also used for steam and return lines, blow-down and gas lines, vents and downspouts. Shaver and Shaver were the architects; Ryan Engineering Company, the consulting engineers.

Byers Wrought Iron pipe has rolled up impressive service records in all these services. And because it has demonstrated its ability to serve longer, it is the first choice of experienced engineers everywhere.

Our booklet, THE ABC's OF WROUGHT IRON, tells how genuine wrought iron is made, where it is successfully serving, why it lasts longer. Write for a copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Division: New York, N. Y.

Why Genuine Wrought Iron Lasts

This notch-fracture test specimen illustrates the unique fibrous structure of genuine wrought iron—which is responsible for the high corrosion resistance of the material. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and disperse corrosive attack, and discourage pitting and penetration. They also anchor the initial protective sacle, which shields the underlying metal.

BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

Heating Piping & Air Conditioning

Vol. 24 No. 8

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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The FLOWLINE Ell is typical. Its long radius and smooth interior walls assure full effective sweep, reduce pressure loss, minimize flow resistance, corrosion, erosion, and product accumulation. The ell is round and ends are accurately machine tool cut and finished, making it easy to fit to pipe.

FLOWLINE Welding Fittings—tees, ells, reducers, stub ends, and caps—are made and normally stocked in Schedules 5, 10, 40, and 80—sizes ½" through 12"—in stainless types 304, 316, 347; Monel, Nickel. All fittings are annealed, cleaned bright — stainless fittings are passivated — and marked with type of metal, heat number, size, schedule, and wall thickness.

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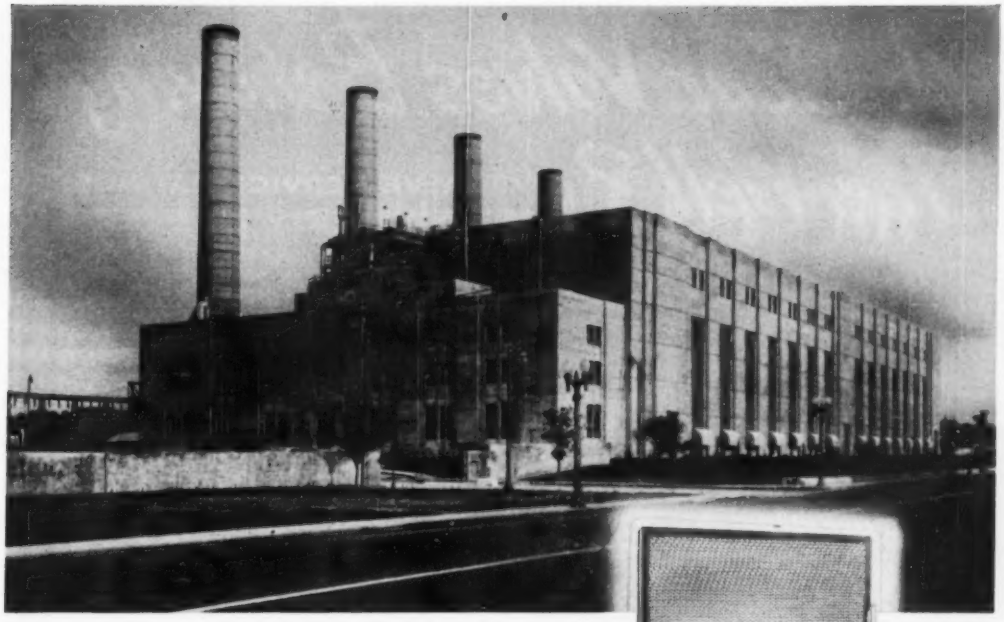
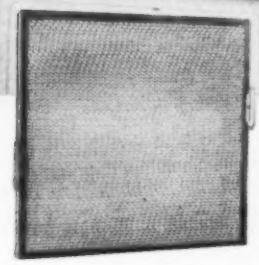
World's Largest Manufacturer of Stainless Welding Fittings





Salt, Sand and Steam

Located 150 yards from the ocean, the Southern California Edison Company's Redondo Steam Plant had a difficult air filtration problem. The blowers were located in the wall facing the ocean and the wall openings were covered by concrete hoods facing toward the ground. The corrosive salt air contained a large concentration of dust and sand, and it was necessary to handle a large volume of air — 240,000 CFM—even though the design of the hoods made filter space limited.

An installation of corrosion resistant FAR-AIR* filters, Type C4C4H was made in the form of a V bank. The installation effectively removed dust and sand while operating at the unusually high velocity of 625 FPM. FAR-AIR filters so satisfactorily solved this complex air handling problem that they have been used by this customer in several other installations.

Whether your air problem involves the elimination of dirt, grease, ink, paint, lint or almost any other airborne particles, you will find the type and size filter to meet your requirements among the many in the FAR-AIR line. Also, special filters for special applications. For complete information write to Farr Company, P.O. Box 10187, Airport Station, Los Angeles 45, California.

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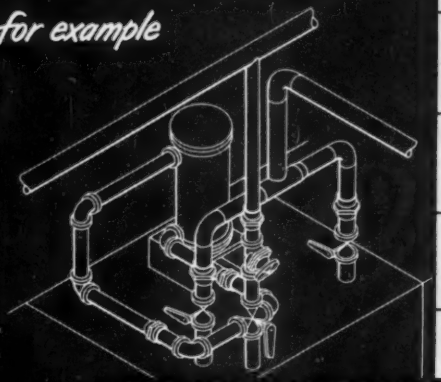
Are Your Valves Behaving This Well?

...on River Water, for example



THE INSTALLATION

Crane Iron Body Diaphragm Valves on hydraulic lines to cylinder operators on ash pit gates; Southwark Station; Philadelphia Electric Company.

VALVE SERVICE RATINGS

SUITABILITY:	Good design for gritty fluid
FEATURES:	Neoprene disc insert resists cutting
MAINTENANCE COST:	Making big savings here
SERVICE LIFE:	Already 6 to 9 times longer than other valves
CORROSION-RESISTANCE:	O.K. no sign of corrosion
PRICE:	Better than many ordinary valves
AVAILABILITY:	Regular number in Crane line

THE HISTORY

Valves were installed in the hydraulic system when the control cocks failed to shut off tight. But like the cocks, conventional valves put in this service didn't stand up. They couldn't handle the abrasive, sandy river water used for hydraulic operators as well as for ash pit sluicing. They leaked badly in 3 to 5 weeks; had to be replaced.

The problem was solved with Crane Iron Body Diaphragm Valves. Installed more than 7 months, there's been no leakage since; no valve trouble of any kind. The Neoprene disc insert and wide, flat seating surfaces in Crane Valves show no effect of abrasion. Their completely sealed bonnet keeps working parts free of grit.

THE VALVE

In Crane Packless Iron Body Diaphragm Valves, the Neoprene diaphragm acts as bonnet seal only; is not subject to crushing and rapid wear. Separate disc with Neoprene insert shuts off flow even should diaphragm fail. Made unlined or with full Neoprene body lining. Well suited for erosive fluids, sludges, slurries; also for many corrosive services. See your Crane Catalog or call your Crane Representative.

The Complete Crane Line Meets All Valve Needs. That's Why
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In the year 1931 Taylor Forge gave industry its *first real line* of seamless, butt-welding pipe fittings. We say it was the first *real* line because it was the first to include not only long and short radius ells, but also full branch and reducing tees, concentric and eccentric reducers, stub ends, caps and welding neck flanges.

This was a fully planned development. Many years before Taylor Forge had foreseen the future of the butt-welding fitting . . . had realized that pipe welding could not go beyond its then crude stage until pipe users were given *all* the fittings necessary to make up complete piping systems.

So Taylor Forge went to work on this and after long research and development came out with the full line that became the inspiration of modern pipe welding.

Naturally the organization that started ahead has kept ahead . . . in design, in quality, in breadth of line. That is why so many men who have followed the development of the WeldELL line, refuse to consider any other kind of welding fittings.

TF

For up-to-the-minute facts, see your Taylor Forge distributor

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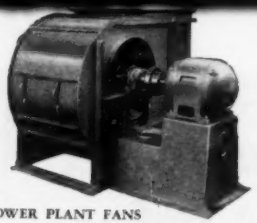
AXIAL FLOW FANS



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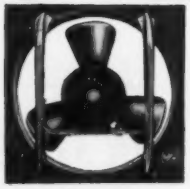
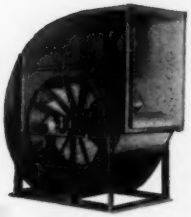


BREEZO FANS



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VOLUME FANS

BELTED VENT SETS

TYPE "CB" PRESSURE BLOWERS

RE BLOWERS-EXHAUSTERS

TYPE "CC" PRESSURE BLOWER

Efficient Air Handling Units
To Satisfied Customers
Since 1877

We welcome the opportunity to solve *your* problem.

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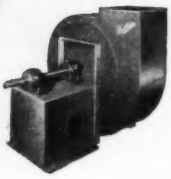
BABY CONOIDAL FANS



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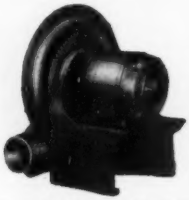
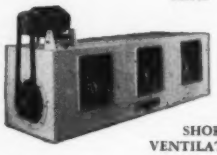


"E" BLOWERS-EXHAUSTERS



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A-C ENGINEERS CAN HELP YOU WITH THESE PROBLEMS

☛ The proper pipe size for the most economical installation.

☛ The type and size pump that best fits the conditions of the job.

☛ Design modifications in the pump that may prove necessary.

ALL THIS is done for you by experienced men who do nothing but pump engineering. Moreover, if you call an A-C representative early in your planning, he may even be able to offer suggestions in the placement of pumps or piping that can mean improved performance or savings in manufacturing cost.

Allis-Chalmers engineers can show you the one best solution to your pump problem. They know the short-cuts, the things to avoid.

You can have more time to devote to design problems!

And Allis-Chalmers has the pumps too! There's a type and size pump for practically every job from fractional units up to the biggest. If needed, Allis-Chalmers will make modifications to do a job.

So call your nearby Allis-Chalmers district office to solve your pump problems or write: Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3573

Electrifugal is an Allis-Chalmers trademark.

ALLIS-CHALMERS PUMPS

***ELECTRIFUGAL* PUMP** — a close-coupled pump combining maximum space for packing maintenance with exceptional rigidity. From motor end housing to pump casing, frame is one piece of cast iron. Sizes 10 to 1600 gpm; heads to 525 feet.

PACKAGE PUMP — with open or closed impeller. Widely used for air conditioning and refrigeration. Made in several fractional horsepower sizes using NEMA standard motors of well-known make. Capacities to 80 gpm; heads to 100 feet.

PEDESTAL MOUNTED PUMP—For use where flexible coupling or V-belt drive is desired. Essentially the same pump as package pump at left, except that bearing bracket is substituted for motor. A-C also furnishes motor, drive, control. See ratings at left.

VERTICAL MOUNTED PUMP — Open impeller unit with special cover plate and flange for vertical mounting. Used in air conditioning to save piping cost. Also used as coolant pump for machine tools. Capacities to 80 gpm; heads to 100 feet.

Why it's better to buy . . .

B & G MONOFLO FITTINGS

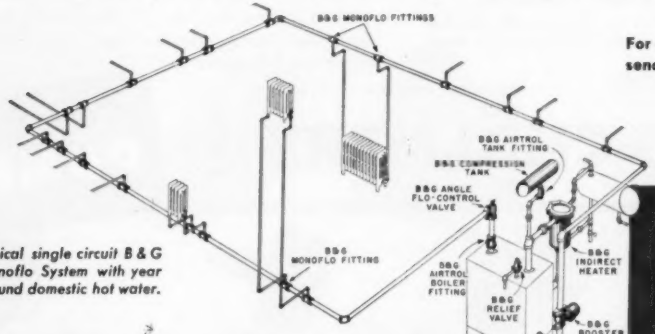
Save time—cut cost—and side-track trouble in one-pipe forced hot water heating systems

Precision-built by specially designed machines

A one-pipe forced hot water system achieves maximum efficiency when equipped with B & G Monoflo Fittings. These fittings are not just "scoops" or "chokes" but *engineered* devices for diverting water in correct amounts into the radiation circuits.

Accurately machined orifices assure proper temperature drops and permit the use of economically sized risers without penalizing the pump with excessive resistance.

And—*this is important to the installer*—B & G Monoflo Fittings are units of exceptionally precise manufacture. The threads are tapped with extreme accuracy by machines designed especially for the purpose. Installation is always easy, with no "cranking" of pipes.



Typical single circuit B & G Monoflo System with year around domestic hot water.

For complete information, send for Bulletin DF-450.

BELL & GOSSETT COMPANY

Dept. CP-5, Morton Grove, Illinois

Canadian License: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto, Canada

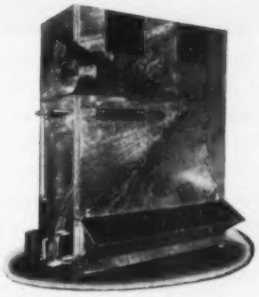
specify ACME

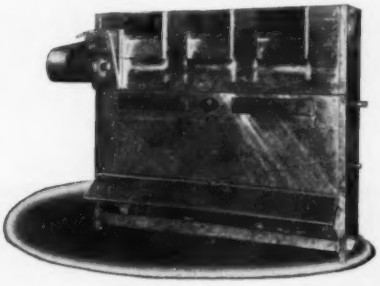
for increased efficiency, economy and long life

ACME Products have been manufactured continuously for more than 30 years. ACME Products are universally accepted and noted for their dependability and fine workmanship. ACME published ratings are accurate and conservative. ACME'S 30 years of engineering experience gives you economy, long life and increased efficiency on which you can build a greater volume of business and increased profits.

EVAPORATIVE CONDENSERS AND HEAVY DUTY COOLING TOWERS

1. Heavier, extra strong construction for durability. **2.** Complete moisture elimination for dry fan operation. **3.** Save more than 90% of the water required. **4.** Built in 3 sections for easy shipment and installation. **5.** Flexible fan arrangement. **6.** Hot-dip galvanized *after* fabrication. **7.** Internally mounted receivers for added storage capacity. **8.** Provision for Micromet threshold water treatment. ALL the above features, with the exception of "internally mounted receivers" and "Micromet threshold water treatment" are also available in ACME Heavy Duty Cooling Towers.





BLO-COLD* INDUSTRIAL UNIT COOLERS

1. Units available for Dry Coil or Brine Spray Operation. **2.** Available for flooded, direct expansion or brine operation. **3.** Coils may be either prime surface or finned; tubes of copper or steel pipes. Fins aluminum or steel. Coils, steel pipes and fins may be hot-dip galvanized. **4.** Vertical or horizontal discharge, easy accessibility to coils. **5.** Economical to operate. **6.** Air inlet front or back.

MODEL J COOLING TOWERS

1. Versatile — Model for all purposes. **2.** With or without pump. **3.** An ideal Jobber item, stock model can be used to meet all requirements.

ACME ALSO MANUFACTURES: Ammonia Condensers ● Freon Condensers ● Shell and Coil and Shell and Tube Condensers ● Dry-Ex* Water Coolers ● Hi-Peak* Water Coolers ● Fin Coils ● Pipe Coils ● Oil Separators ● Liquid Receivers ● Heat Exchangers ● Flow-Cold* Liquid Chillers ● Convectors

* Trade Mark

ACME INDUSTRIES, INCORPORATED
JACKSON, MICHIGAN
CONTINUOUSLY SERVING THE REFRIGERATION INDUSTRY SINCE 1919

Living rooms, bedrooms, dinettes and kitchens in these new, ultra-modern Valley Village Apartments in Minneapolis are enjoying June in January thanks to Fedders Baseboard Radiation. This is another typical example of why architects, general and heating contractors demanding the finest, specify and install Fedders Baseboard Radiation.

VALLEY VILLAGE APARTMENTS,
Minneapolis, Minn.

Owner: Valley Village, Inc.

Architect: Gerhard W. Brandhorst, Minneapolis, Minn.

General Contractor: Sebco, Inc., Minneapolis, Minn.
Enaco, Inc., Minneapolis, Minn.

Plumbing & Heating Contractor: H. R. Nichols Co., St. Paul, Minn.

with **fedders**

A GREAT NAME IN COMFORT

Baseboard Radiation

This new idea in heating is making warm friends everywhere! Compact . . . inconspicuous . . . space-saving . . . Fedders Baseboard Radiation is in perfect harmony with every color scheme and provides uniform comfort wall-to-wall. Covers have Fedders exclusive anti-streak design which reduces cleaning and redecorating costs.

THE PICK OF THE PACKERS

Out where the West *ends* . . . many of the great meat packers use Worthington *refrigeration* machinery.

And all over the country, many famous *restaurants*—Toffenetti's in Times Square, Silver Fox Restaurant in Washington, The Century Room, Dallas—use Worthington *air conditioning machinery*.

When you specify "Worthington", you specify the air conditioning and refrigeration equipment that's used by the "first" names in every field.

No other manufacturer makes *so complete* a line. A Worthington system is all Worthington-*made*—not just Worthington-assembled—assuring you of perfectly balanced operation and unit responsibility.

Worthington Corporation, formerly Worthington Pump and Machinery Corporation, Air Conditioning and Refrigeration Division, Harrison, New Jersey.

America's Leader's... in Many Businesses... Select

WORTHINGTON

A-7-11

AIR CONDITIONING AND REFRIGERATION

The Most Complete Line... Always the Correct Recommendation

Design Engineers: Abbott, Merkt and Company, Inc.
Design Architects: Kahn and Jacobs
Consulting Engineers: Edward E. Ashley

NEW HECHT STORE chooses...

● Handsome efficient Kno-Draft Air Diffusers bring conditioned air – gently, evenly, and *without drafts* – into The Hecht Co.'s new Parkington-Arlington store at Arlington, Virginia.

Here, as with every Kno-Draft job, a lot less preliminary figuring had to be done because Kno-Draft Air Diffusers are adjustable *after* installation. This not only reduces slide rule work but assures the customer the exact comfort level desired. Air volume and direction of flow can be regulated with no other tool than a screw driver.

Kno-Draft *Adjustable* Air Diffusers are being specified for more and more commercial and industrial applications. Get the full story on their many engineering advantages. Mail the coupon today to W. B. Connor Engineering Corporation, Danbury, Connecticut.

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adjustable air diffusers

W. B. CONNOR ENGINEERING CORP.
Dept. G-82, Danbury, Connecticut

Please send me the *new edition* of the Kno-Draft Data Book—without obligation, of course.

Name_____

Position_____

Company_____

Street_____

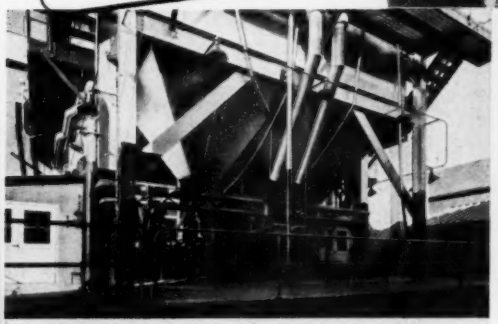
City_____ Zone____ State____

"We modernized our plant, installed new COAL-burning equipment, AND CUT OUR FUEL COSTS 45%!"

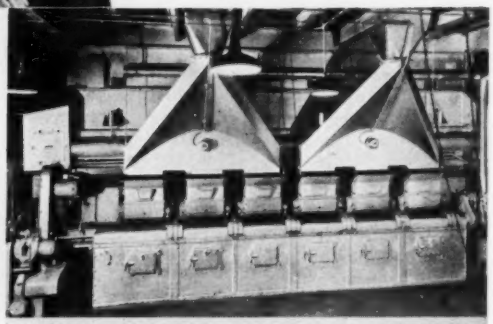
says MR. A. J. GOETZ, Executive Vice President, River Raisin Paper Co., Monroe, Michigan.

"We recently modernized our entire plant following an extensive engineering survey. New coal-burning and coal-handling equipment was installed . . . heat losses were reduced . . . efficiency raised. As a result, our fuel costs have been cut 45 to 50%—proving to us that you just can't beat bituminous coal burned the modern way."

"In Addition, Automatic Coal- and Ash-Handling Equipment Cuts Labor Costs 60%!"



This view shows how River Raisin has installed its modern fly-ash reinjection system at the rear of the boilers but outside the plant. The plant also features outdoor coal handling to save additional interior space.



"We chose these modern spreader stokers for their advantages of low maintenance, low power requirements, and their ability to meet fairly rapid load changes. They give us maximum efficiency under all operating conditions."

Modernizing your present plant? Building a new one? In either case let a consulting engineer show you exactly how you can meet your *specific* needs with a modern coal installation—and at the same time save more money than you thought possible.

Automatic coal- and ash-handling equipment can cut your labor costs to a minimum. And, today, with a modern combustion installation, you can actually get 10 to 40% more power from each ton of coal than was possible a few years ago.

Moreover, with coal you'll never have to worry about a shortage of fuel. America's coal reserves are virtually inexhaustible, and this coal is mined by one of America's most efficient and productive industries. This means that coal users—unlike those committed to other fuels—get the advantage of dependable future supply as well as more stable prices.

If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—for hundreds of years to come.

COAL production in the U. S. A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

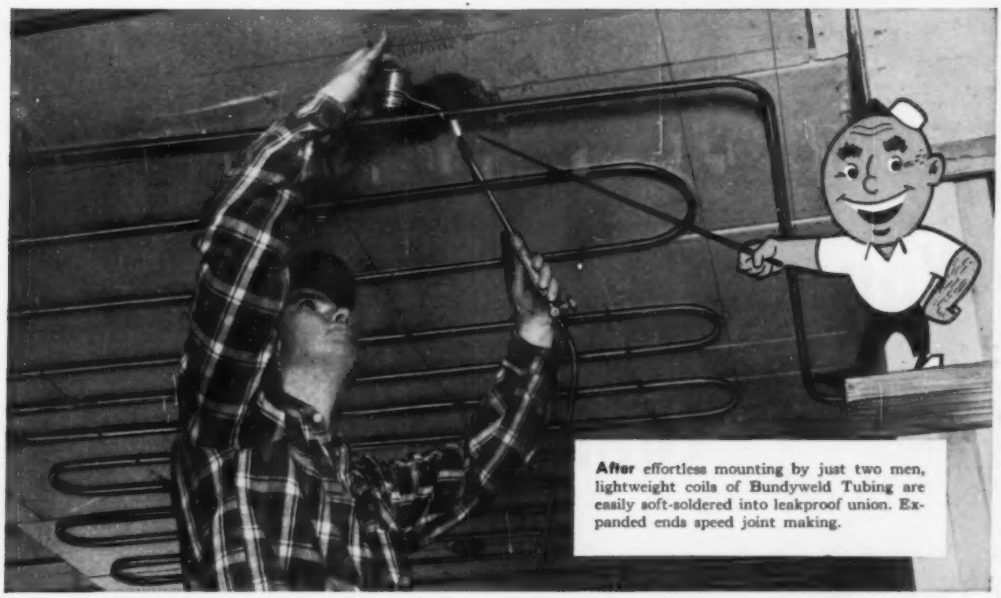
COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

BITUMINOUS COAL INSTITUTE
A Department of National Coal Association, Washington, D. C.

FOR HIGH EFFICIENCY ★ FOR LOW COST

YOU CAN COUNT ON COAL!



After effortless mounting by just two men, lightweight coils of Bundyweld Tubing are easily soft-soldered into leakproof union. Expanded ends speed joint making.

Be first in your locality with the newest — Bundyweld Ceiling Radiant Heating

Key to Low Cost

Bundyweld is the only tubing double-walled from a single strip. It's steel, copper-coated inside and out. It gives finest radiant heating performance, with savings up to 50% on material costs and installation time.

Standard 20′ or 24′ lengths of Bundyweld are easily formed into coils in shop or on job site. Expanded ends (furnished when specified) are quickly soldered into leakproof union. Joined, lightweight coils are easily mounted onto ceiling, quickly plastered over.

Beat your competitors to the punch!

Every day more builders and plumbing and heating contractors are putting the emphasis on Bundyweld Ceiling Radiant Heating—today's fastest-growing, most practical heating method.

More and more prospective home buyers and home builders are inquiring with eager interest about such features as lower operating costs, healthfully moderate air temperatures, absence of dirt-catching radiators and registers, streak-free walls and ceilings, unlimited choice of flooring materials.

Proof? Bundy ads in *Better Homes & Gardens* and *American Home* bring coupons from thousands of people wanting the full story on Bundyweld Ceiling Radiant Heating *plus* the names of builders and plumbing and heating contractors installing it.

Send coupon today for details on Bundyweld Ceiling Radiant Heating and Bundyweld Tubing.

Radiant Heating Division

BUNDY TUBING COMPANY

Detroit 14, Michigan

SEND TODAY! FREE!

LIKE HAVING THE SUN IN YOUR CEILING

Bundyweld Ceiling Radiant Heating

Radiant Heating Division, Dept. HP-852
Bundy Tubing Company, Detroit 14, Michigan

☐ Send free 20-page nontechnical brochure explaining Bundyweld Ceiling Radiant Heating.

☐ Send Bundy technical radiant heating pamphlet.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

You get *MORE* than just steel

Personalized service is the big "plus" you get when you come to us for your warehouse steel requirements.

Warehouse steel is a bargain for you when you take full advantage of the "no extra charge" service United States Steel Supply's team of technical and service experts will give you.

Full information on available steel supplies . . . current prices . . . latest in production techniques . . . machinery and shop supplies . . . will be brought to you *personally* by the United States Steel Supply salesman, who regards your needs as his personal responsibility.

Get more than just steel
by calling your source of *personalized steel service* . . .

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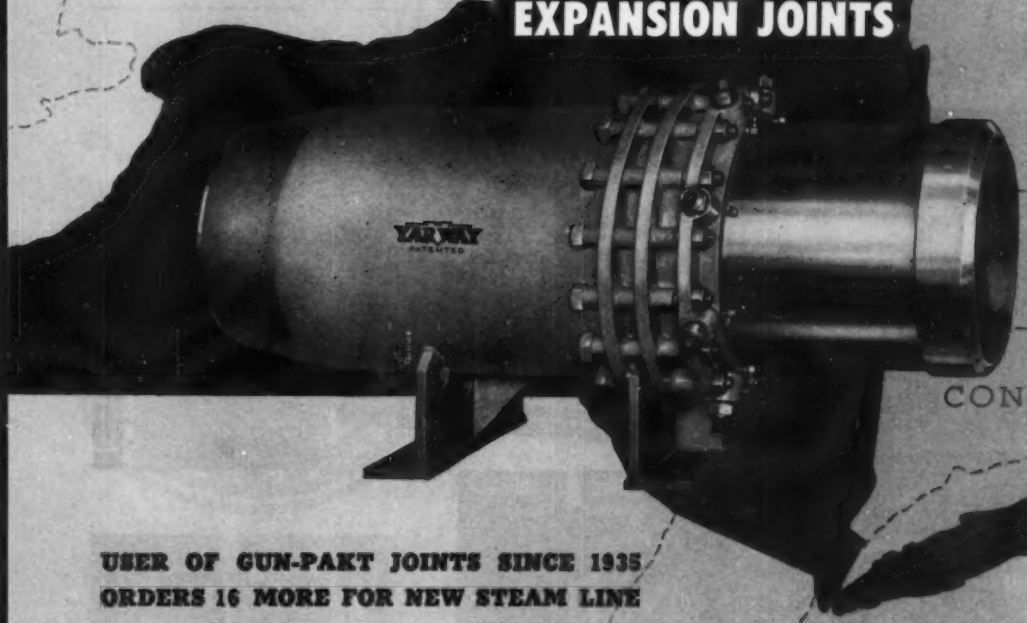
UNITED STATES STEEL

ROCHESTER GAS & ELECTRIC SPECIFIES . . .

GUN-PAKT EXPANSION JOINTS



USER OF GUN-PAKT JOINTS SINCE 1935 ORDERS 16 MORE FOR NEW STEAM LINE

This prominent New York State utility has been using Yarway Gun-Pakt Expansion Joints for the past 17 years. Now they have ordered 16 more (12", max. working pressure 400 psi) for a new steam distribution line in their expanding system—pretty good proof that Gun-Pakt Joints give trouble-free, economical service.

Central station heating plants, institutions and industrial plants all over the country are finding Gun-Pakt Joints offer *maximum protection* with *minimum maintenance*. Gun-Pakt Joints are *rugged, strong* joints. They offer freedom from shutdowns because they are *serviced under full steam pressure*. Maintenance costs are low; one utility that kept accurate records found their maintenance costs to be only 65c per year per joint!

To service a Gun-Pakt Joint you simply insert a plug of packing, twist a wrench, and the joint is tight . . . the job done . . . all without taking pressure off the line.

Yarway engineers, conveniently located near you, are constantly working for better, more profitable steam plant operation. Call on your Yarway man for friendly, helpful advice.

Yarway Gun-Pakt Expansion Joint installed in Rochester Gas & Electric Corporation's Broad St. subway line. 10" joint, 225 lbs. pressure, 450°F.

YARNALL-WARING COMPANY
107 Mermaid Avenue, Philadelphia 18, Pa.
Branches in principal cities

YARWAY SERVICE GOES ALL THE WAY . . .

SPANG® CW STEEL PIPE

is head of the class

at Jefferson High School

OWNER:
Jefferson County Board of Education, Dandridge, Tennessee

ARCHITECT:
Baumann & Baumann, Knoxville, Tennessee

GENERAL CONTRACTOR:
Johnson & Willard, Knoxville, Tennessee

PIPING CONTRACTOR:
White Plumbing & Heating Company, Knoxville, Tennessee

Example of the *best* in modern schoolhouse design, this high school in Tennessee is a mighty pleasant place to work and play. It's bright, airy and always comfortable even in deepest winter . . . a natural result of a heating system as carefully planned as the rest of the building.

When it came to selecting pipe, Spang CW Steel Pipe was "head of the class" as far as everyone was concerned. So Spang CW black was used exclusively for this three-zone, two-pipe, vacuum heating system; and Spang CW galvanized pipe supplies the siamese connections and fire hose cabinets throughout the building.

Whenever reliability is a *must,* you, too, will find it pays to specify this better pipe. *Quality-controlled* from raw material to finished pipe, Spang CW is always uniform in every way . . . always dependable. What's more, you'll find it easy to cut, easy to thread, easy to bend because we watch temperatures with extra-care all during forming.

Ask for it from your nearby Spang Distributor.

SPANG

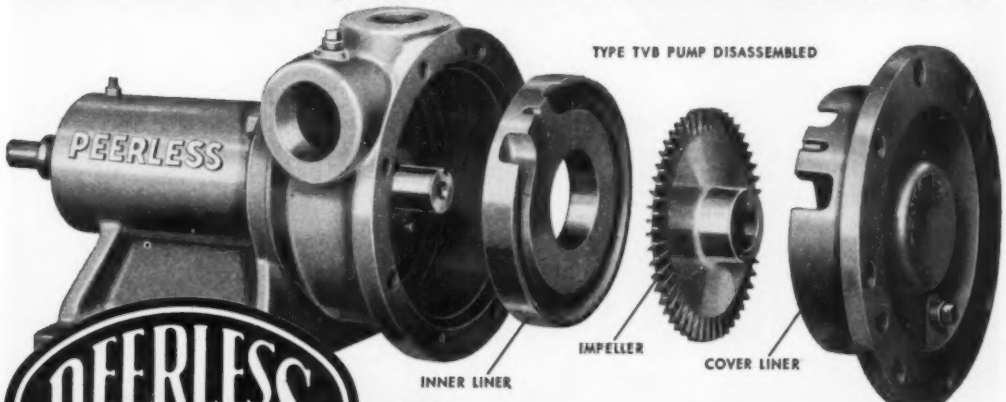
SPANG-CHALFANT

DIVISION OF THE NATIONAL SUPPLY COMPANY

General Sales Office: Pittsburgh 30, Pa. District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis

SO SIMPLE

TO OPERATE, INSPECT AND MAINTAIN

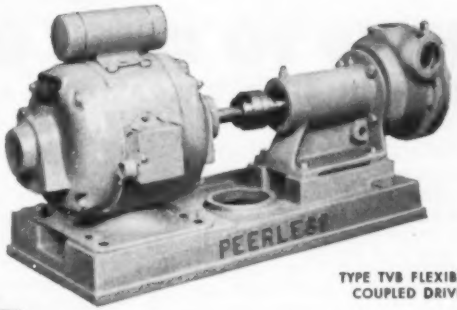


PEERLESS PUMPS

PEERLESS TURBINE VANE TYPE PUMPS

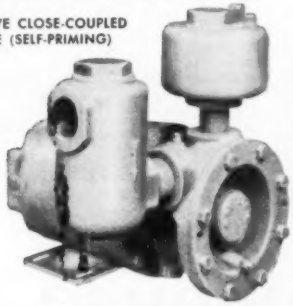
FOR PUMPING HOT AND COLD, CLEAR AND VAPOROUS LIQUIDS

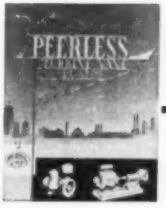
Peerless offers the complete line of easy to understand, easy to apply and simple to service all-purpose turbine vane pumps. Use these Peerless electric close-coupled (Type TVE) or flexible-coupled (TVB) pumps to move clear liquids in moderate capacities against medium and high heads. A wide selection of types and sizes and standard or self-priming models allow them to fit into almost any piping or pumping layout and into system sub-assemblies. There are no easier pumps to service; disassembly for inspection, replacement or repair is done in a matter of minutes. Standard Peerless materials are cast iron case, bronze impeller and liners, stainless steel shaft and mechanical shaft seal. Capacities: to 58 gpm. Heads: to 800 feet. Close-coupled and flexible-coupled electric drives are available.



TYPE TVB FLEXIBLE-COUPLED DRIVE

TYPE TVE CLOSE-COUPLED DRIVE (SELF-PRIMING)





NEW BULLETIN No. B-2205; it is so comprehesive that you can make your selection of the right pump for the job from the bulletin. Mail coupon today for your copy.

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
Factories: Los Angeles, California, and Indianapolis, Indiana
Offices: New York; Atlanta; Chicago; St. Louis; Phoenix; Los Angeles, Fresno; Dallas, Plainview and Lubbock, Texas; Tulsa; Albuquerque
Distributors in Principal Cities; Consult your Telephone Directory

PEERLESS PUMPS fmc

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
301 West Avenue 26
Los Angeles 31, California

Please send a copy of Peerless Turbine Vane Pump Bulletin No. B-2205.

Name_____

Company_____

Street_____

City_____ State_____

HPAC

On each machine, a powerful stream of air draws tiny dust particles into the collection system before they can be dispersed and become a health or maintenance problem.

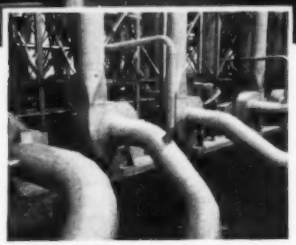
HOW TO "DUST OFF"

150 MACHINING OPERATIONS AT ONCE

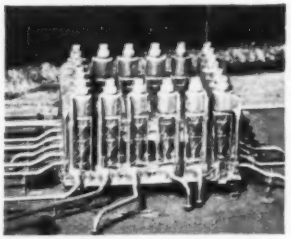
They're literally giving dust "the air" at Formica's new Cincinnati plant. With more than 150 micro-sanding and finishing machines working on decorative sheets or laminated shapes, well over 100 pounds of fine dust are created every hour. Unchecked, it would represent a hazard to worker health and efficiency as well as a costly cleaning and maintenance problem.

The answer? A dust collection system was designed and installed by Kirk & Blum using 32 powerful Westinghouse-Sturtevant fans. Through individual hoods serving each machine, 218,000 cfm of air picks up dust particles and carries them to collectors on the plant roof. Although completely exposed to the elements, expert engineering and rugged construction has given these fans the ability to "take it" and still perform at top efficiency the year 'round.

To help you *put air to work*—with air handling, air conditioning or air cleaning—Westinghouse offers a complete line of industry-proven equipment to meet your individual needs. See the new General Catalog 600, a 60-page reference file, describing the full product line and its industrial applications. To get a free copy, call your local Westinghouse-Sturtevant office, or write Westinghouse Electric Corp., Sturtevant Division, Hyde Park, Boston 36, Mass.



Carefully designed blades in these Westinghouse fans give highest operating efficiencies with lower power consumption.



A 20-collector Kirk & Blum system handles dust particles 100 microns and smaller in size with 99.5% collection efficiency.

YOU CAN BE SURE... IF IT'S Westinghouse

J-80271

TUNE IN ON HISTORY! Only Westinghouse brings you complete coverage of political campaign over CBS television and radio.

AIR HANDLING

®Reg. U. S. Pat. Off.

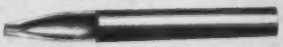
Tubular Parts now made with Fewer Operations

Tool cost reduced
Production and assembly time cut
Functional purpose of part often improved
Eye-appeal of finished part enhanced

by WOLVERINE'S

SPUN END PROCESS*

This copper tubular part was made in two operations: 1) Forming end to a semi-spherical shape by spinning; 2) The combined process of coining to a flat-end and piercing in punch press. The thickness of the finished end section is approximately double that of the original wall of the tube, making a substantial land for the soldering connections.



This formed copper tube—¾" O.D.—is an excellent example of a long accurate reduction, ending in an opening with a controlled I.D. The metal at the end is thicker than the wall of original tube. Inside of small opening is smooth.

A "long neck" type of reduction. A 1⅜" tube has been reduced to ⅝" for a distance of 4¾". The beginning wall thickness is .022" and the reduced portion .045". This one-piece construction presented difficulties when manufactured by another method.

The Spun End Process brings another advancement to industry. In refrigeration, for example, it is now possible to produce accumulative driers that: 1) Keep moisture out of the refrigeration system; 2) Eliminate separate drier—thereby reducing costs; 3) Prevent chances of plug-up thus making it less susceptible to pressure drop; 4) Obviate possibility of silica gel coagulating; 5) Assures against deterioration of unit by enclosing silica gel in supported mesh bag. We now produce accumulator driers in the following sizes: 15, 20 and 30 gram.

* A PATENTED PROCESS RE. 23469

LET'S MENTION A FEW OTHER PRACTICAL END TREATMENTS

- Reduced opening, wall thickened and turned back inside tube.
- Round end, threaded O.D.
- Round end, threaded I.D.
- Reduced opening, long neck
- Round end with clevis
- Square end, open
- Reduced opening, short neck
- Spherical closure wall slightly heavier on end.
- Conical closure
- Reduced opening, no neck

Perhaps you have, or contemplate, a part that could be produced more economically by this modern process. Would you like a copy of our new Spun End Tube Brochure?

Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ontario.

WOLVERINE TUBE DIVISION
Calumet and Hecla Consolidated Copper Company
INCORPORATED

Manufacturers of tubing, exclusively
1419 CENTRAL AVE. • DETROIT 9, MICH.

Wolverine Mill Depots:
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Sales Offices in Principal Cities

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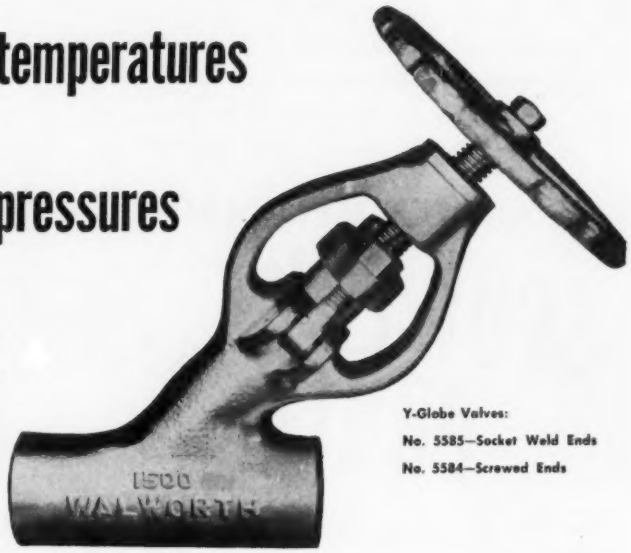
Walworth's NEW small cast steel valves

SERIES 1500 – SIZES ¼ to 2 inches

handle HIGH temperatures
HIGH pressures



Y-Globe Valves:
No. 5585—Socket Weld Ends
No. 5584—Screwed Ends

Walworth is proud to make these new Small Cast Steel Valves available to power stations . . . oil refineries . . . ships . . . wherever piping is subject to severe pressures and temperatures. Non-shock service ratings of these valves: 1500 psi–950F for steam; 3600 psi–100F for water, oil or gas. Cast of chromium molybdenum steel, they are compact and light, yet exceptionally strong. Both Y-Globe and Angle type valves are available.

Angle Valves:
No. 5587—
Socket Weld End
No. 5586—
Screwed End

Simplified Walworth design eliminates many of the valve problems encountered in high pressure service. Among the features of this new valve are:

INTEGRAL BODY AND YOKE – made from a single casting without threading or welding. Bonnet joint — always a potential source of leakage — is eliminated. Valves can be reassembled quickly and easily.

ROTATING DISC – prevents valve seat distortion and consequent leakage. Cuts down replacements.

WELDED SEAT RING – compensates for changes in pressure and temperature—eliminates a major source of leakage.

SPECIAL BACK SEAT BUSHING – permits repacking the valve under pressure with greater safety.

PACKING CHAMBER – designed to dissipate heat thus keeping packing rings at lower temperatures—gives them longer life.

These valves are available with either socket weld ends or screwed ends, in sizes ranging from ¼ to 2 inches. For further information on Walworth series 1500 Small Cast Steel Valves, see your local Walworth distributor, or write for Circular No. 134.

WALWORTH

valves • fittings • pipe wrenches

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Look

Outside ... and Inside

when selecting your

PACKAGE STEAM GENERATOR

ALL STEEL WELDED CONSTRUCTION of casing suitable for outdoor installation.

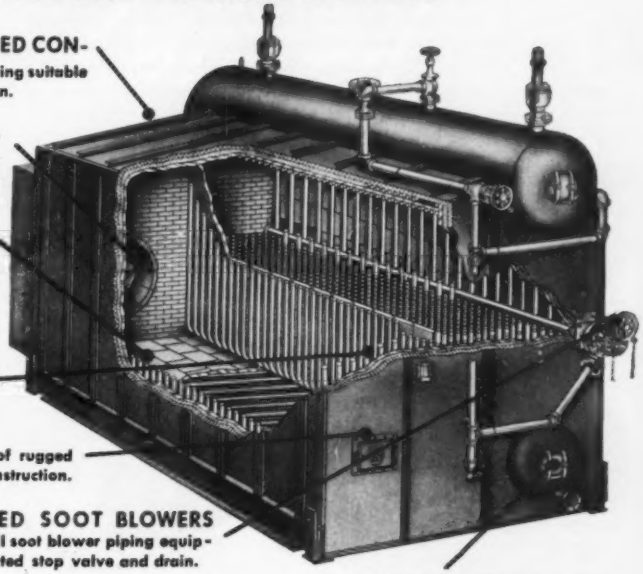
TWO BURNERS on units over 22,500 lb per hr. All burner registers are hinged to permit easy access to diffuser and register louvers.

FURNACE WATER WALLS backed with 2" first quality fire clay tile, 2" block insulation and 2½" rock wool blanket.

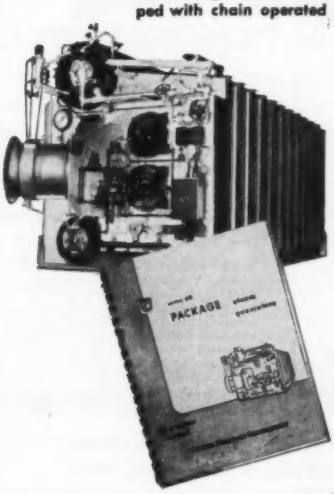
REAR FURNACE WALLS are water cooled for full height of furnace, tie in to boiler circulation without use of headers.

ACCESS DOORS of rugged brick lined cast iron construction.

DOUBLE - ENDED SOOT BLOWERS on the larger units. All soot blower piping equipped with chain operated stop valve and drain.



MANHOLES at both ends of each drum for capacities in excess of 15,000 lb per hr.



Foster Wheeler Package Steam Generators offer you these marks of quality and efficiency, plus water-tube design, large furnace volume and electronic combustion control.

Rugged factory assembled units, they are available in capacities from 10,000 to 30,000 lb per hr, and are easily installed for either inside or outdoor operation.

For further information, write for Catalog PG-51-2, and for article "WATER TUBE PACKAGE STEAM GENERATORS"

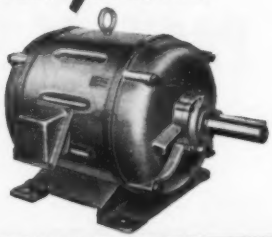
FOSTER WHEELER CORPORATION
165 Broadway, New York 6, N. Y.

FOSTER WHEELER

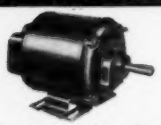
Wagner
ELECTRIC MOTORS
...the choice of leaders in industry

Wagner Quality Motors *for your product or your plant*

When you select a motor from Wagner's complete line, you get a motor that is completely dependable in its specific application. You can choose from a wide variety of types and sizes. Here are a few of the motors in the Wagner line. At right is TYPE RP—open type polyphase squirrel-cage motor. It is drip-proof and suitable for all general purpose applications. 1/6 to 400 hp.

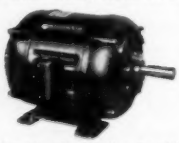


SINGLE-PHASE

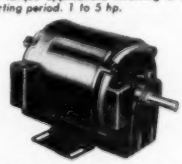


TYPE RB—*Split-phase Induction. For easy starting applications with high starting current. 1/20 to ½ hp.*

TYPE RK—*Capacitor-Start Induction. For general purpose applications requiring high starting torque—normal starting current. 1/6 to 3 hp.*

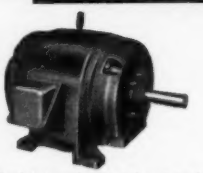


TYPE RG—*Repulsion-Induction. For high starting torque applications involving a very long starting period. 1 to 5 hp.*



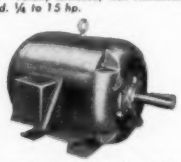
TYPE RA—*Repulsion-Start Induction. For general purpose applications with high starting torque—low starting current. ½ to 15 hp.*

POLYPHASE MOTORS



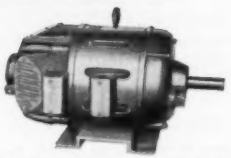
TYPE XP—*Splashproof. Protected against splashing or dripping liquids. ¾ to 200 hp.*

TYPE TP—*Totally-enclosed, non-ventilated. Fully protected. ¼ to 15 hp.*



TYPE CP—*Totally-Enclosed Fan-Cooled. Protected against dirt, chips, abrasives or fumes. Steel frame. 1 to 250 hp. Also in explosion proof type HP.*

TYPE EP—*Corrosion-resistant Totally-Enclosed Fan-Cooled. Cast iron frame. 2 to 250 hp. Also available in explosion proof type JP.*



TYPE RS-1—*Wound Rotor. Constant or adjustable varying speed. 1 to 250 hp. TYPE RS-2 for intermittent service. 2 to 200 hp.*

GEAR MOTORS—*Single-phase or Polyphase. Open or enclosed types. 1/20 to 50 hp.*

DIRECT CURRENT MOTORS—*Companion line to Wagner A.C. Motors. 1/6 to 3 hp.*

* * *

In addition to a complete line of motors, Wagner also furnishes Increment Type Motor and Starter Combinations, Jet Pump Motors and a complete line of Transformers: Dry-type, Distribution and Power. Wagner engineers welcome an opportunity to serve you. Consult the nearest of 32 Branch offices, or write direct.

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AUTOMOTIVE BRAKE SYSTEMS – AIR AND HYDRAULIC

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4339-9

Drop Forged SteelS

W-S Screw-End and Socket-Weld Fittings

That's right, W-S emphasizes the *plural* when it comes to the various steels for forged fittings.

From Monel down to the full range of carbon types, including low sulphur and phosphor-controlled grades, W-S *forged* fittings spark the trend toward specialized materials for specialized needs.

What's your problem? STRENGTH? W-S is a leading supplier to the high-pressure, high-temperature power industry. CORROSION? W-S stainless and alloy fittings tie America's main arteries of chemical production. SANITATION? W-S is a big producer of the popular Type 304 for food and pharmaceutical operations. Low temperature? Another W-S specialty.

And there's one problem common to all . . . COST. Let us show you how W-S *forged* fittings provide the lowest *service* cost obtainable.

9-M-2

• **Stronger** • **Smaller** • **Lighter** • **Tighter**
• **More Uniform** • **Lower *Service* Cost**

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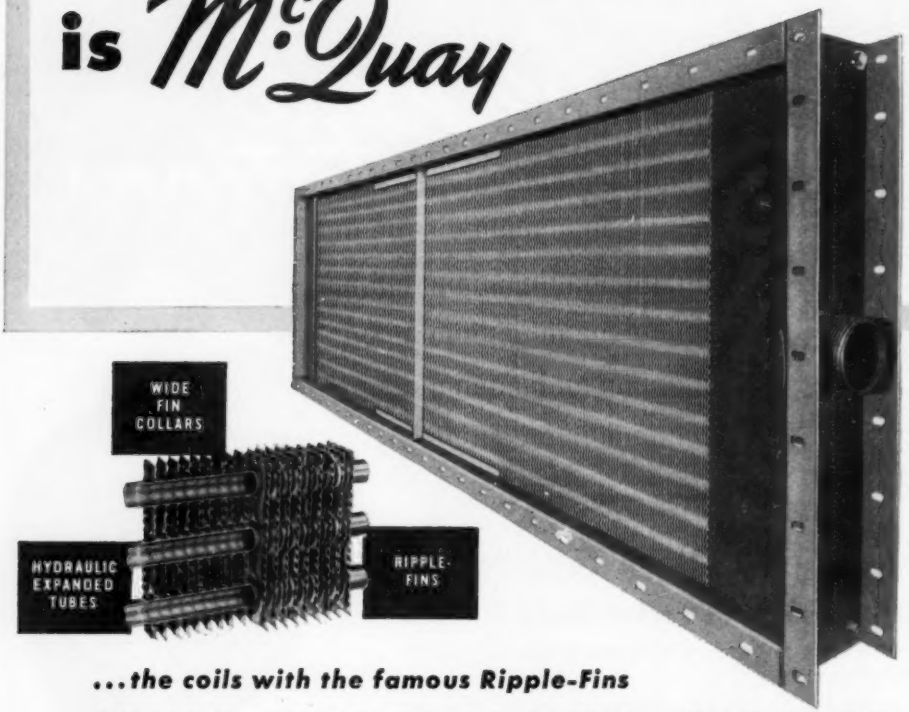
the name for top efficiency in coils

is McQuay



...the coils with the famous Ripple-Fins

McQuay's ripple-fin surface is the product of years of research aimed at producing the ultimate in heat transfer for any weight metal. High efficiency is assured by forcing the air to follow an ever-changing direction of flow in passing through the coil. Thus the air repeatedly contacts the coil surface to give maximum contact time, maximum contact velocity, and a resultant optimum heat transfer.

The staggered tube and rippled edge features also contribute greatly to the construction ruggedness and eye appeal of the famous McQuay line.

McQuay heating (blast) coils are available in a wide variety of styles and sizes. Hot water, cold water, brine, direct expansion, and refrigerant condensing coils are available for practically every type of application. Write McQuay Inc., 1601 Broadway St., N.E., Minneapolis 13, Minn. Representatives in principal cities.

McQuay INC.

MAKE THE SEASONS COME TO YOU

AIR CONDITIONING • REFRIGERATION HEATING

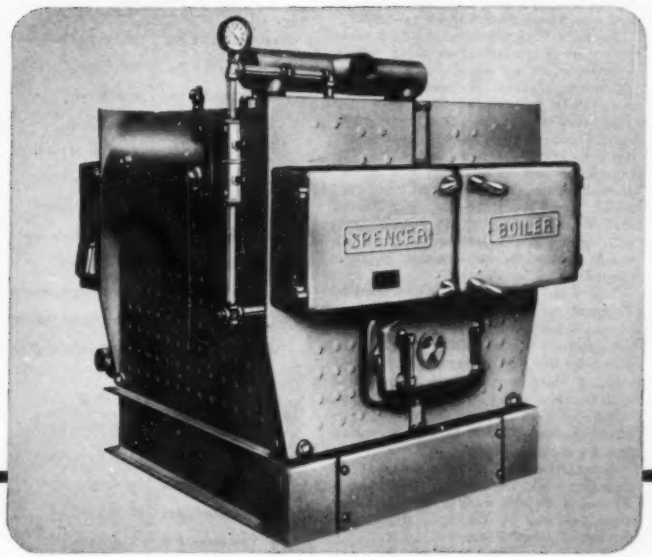
NOW! A real advance in Boiler Design!

SPENCER'S

NEW DIVIDED LOW-WATERLINE BOILER!

We flattened it out to beat the headroom problem! Overall height is approximately 25% less than conventional firebox boilers.

We divided it in half to help you get it through narrow basement openings. The two watertight sections can be moved in separately, yet require no welding for installation and assembly.



The new Spencer Divided Low-Waterline Boiler is available in a range of sizes from 3,500 to 42,500 square feet, steam. Working pressures are 15 pounds steam and 30 pounds water. Also available for working water pressures up to 100 pounds.

Fast-steaming through the use of staggered rows of fire tubes. **Self-cleaning**—since water sides of heating surfaces are kept free of sediment. **Instantaneous or tank-type** service water-heating coils in a wide range of capacities. **Quickly convertible** from mechanical to hand-firing, whenever desired. **High firebox** for quiet and complete burning of fuels.

Only one of Spencer's complete line of boilers

THERE'S A SPENCER FOR EVERY BUILDING...FOR EVERY FUEL

Designed, constructed and stamped in accordance with requirements of the ASME Boiler Construction Code.

Rated in accordance with SBI Code.

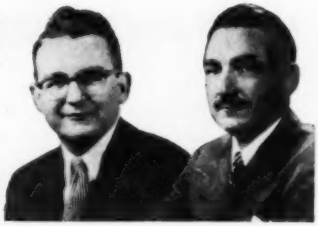
Inspected and approved by licensed National Board Insurance Inspector.

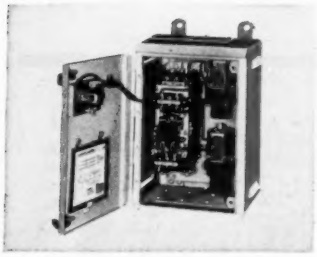
SPENCER
HEATER
LYCOMING-SPENCER DIVISION
WILLIAMSPORT PENNSYLVANIA

The Triumph Manufacturing Co.

"Galley duty in the Navy requires a motor control as rugged as the machine"

say Sheldon B. Storer (right) and Samuel T. Bryant (left), Sheldon Storer & Associates, Cincinnati, Ohio, representatives, Ward Leonard Electric Company.





This Triumph vertical "kitchen" machine is used by the Navy for everything from mixing dough to cutting French-fried potatoes, grinding coffee, sharpening cutlery.

Such machines are operated by a wide variety of people wherever naval vessels or installations are found and it is essential to keep them in operation with a minimum of down-time.

In order to meet exacting Navy standards, Triumph consulted Ward Leonard for a motor control. Because of their long experience and excellent record in the production and development of Navy controls of many types, Triumph was assured that Ward Leonard could supply them with sturdy, trouble-free equipment which would match the construction of their ruggedly built machines.

The Ward Leonard controllers used by Triumph vary depending on whether the power supply is a-c or d-c. For d-c applications they are Ward Leonard, Bulletin 4556, across-the-line starters, magnetic type, continuous duty, semi-automatic operation with overload and low voltage protection, drip-proof enclosure and spray-tight push-button station; Bulletin 4651, is the equivalent for a-c applications.

Complete operating and maintenance instruction books were supplied the Navy as a result of the team work of William Leuze, chief engineer of Triumph, and Samuel Bryant of Ward Leonard.

Ward Leonard field engineers are always ready to work with you to solve your electrical control problems. When your production demands exact engineering, quality manufacturing, prompt, efficient handling and shipping, call on Ward Leonard.

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efficiently designed for sidewall and baseboard installations

The Standforated sidewall registers have horizontal bendable bars, set at time of fabrication for 30 degree downward deflection. Each bar can be easily readjusted with a tool to any angle for upward, downward or straight flow. **No. 41H SIDEWALL REGISTER** has a single damper and 3/16" turned down edge for flush sidewall installation. Sponge rubber gaskets are attached. **No. 42H BASEBOARD REGISTER** has a single damper and 7/8" projection top and two ends, for baseboard installation. Also available as: **No. 42H BASEBOARD INTAKE** and **NO. 40H SIDEWALL GRILLE.** Prime coat or metallic finish—standard screw holes. Over-all of face is listed duct dimension plus 1 3/8".

DUCT SIZE
8" x 4"
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*8" x 6"
10" x 4"
10" x 5"
*10" x 6"
10" x 8"
12" x 4"
12" x 5"
*12" x 6"
12" x 8"
14" x 4"
14" x 5"
*14" x 6"
14" x 8"
24" x 4"
24" x 5"
24" x 6"
24" x 8"
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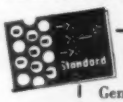
30" x 5"
30" x 6"
30" x 8"

*stock items

Registers are visible symbols of comfort. On your jobs, you want the best to show . . . so, to be *sure*, use Standard Stamping's Registers and Grilles. All Standard registers are engineered for accurate and easy operation. Illustrated above is model No. 41H Sidewall Register. The side view shows * one of the *two damper tension screws* that are adjustable to meet your operational requirements. The tension screws are set at the factory for positive operation. On the damper control lever is Standard's new **FRACTIONATOR VOLUME CONTROL.** This amazing new device allows you to set the damper for optimum volume in balancing your heating system, and maintain that balance permanently.

MAIL COUPON NOW FOR MORE INFORMATION, FREE!



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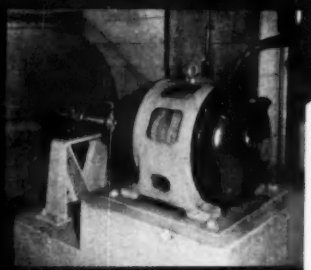
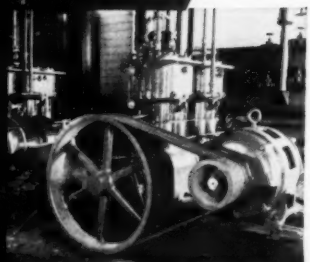
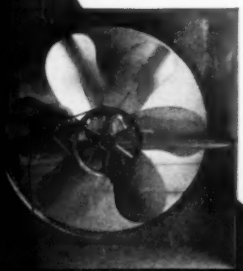


100 horsepower Century motor on a glass blowing machine.



Two 100 horsepower Century motors driving refrigeration compressors.

Century ½ horsepower capacitor motor on a furnace blower.



1/6 horsepower Century motor on a ventilating fan.

WHY Century MOTORIZED EQUIPMENT KEEPS YOUR CUSTOMERS *SATISFIED*...

The motor specifications—where skillfully selected—to assure the TOP PERFORMANCE and DEPENDABLE QUIET SERVICE that is built into each class of equipment.

Refrigeration compressors require one combination of operating characteristics and specifications—fans and blowers another combination—various types of heating equipment still another.

In over 50 years, Century has developed a wide line of types of motors with literally hundreds of specifications to choose from. It is easy to ENGINEER YOUR PRODUCT PERFORMANCE—THROUGH SKILLFUL MOTOR APPLICATION.

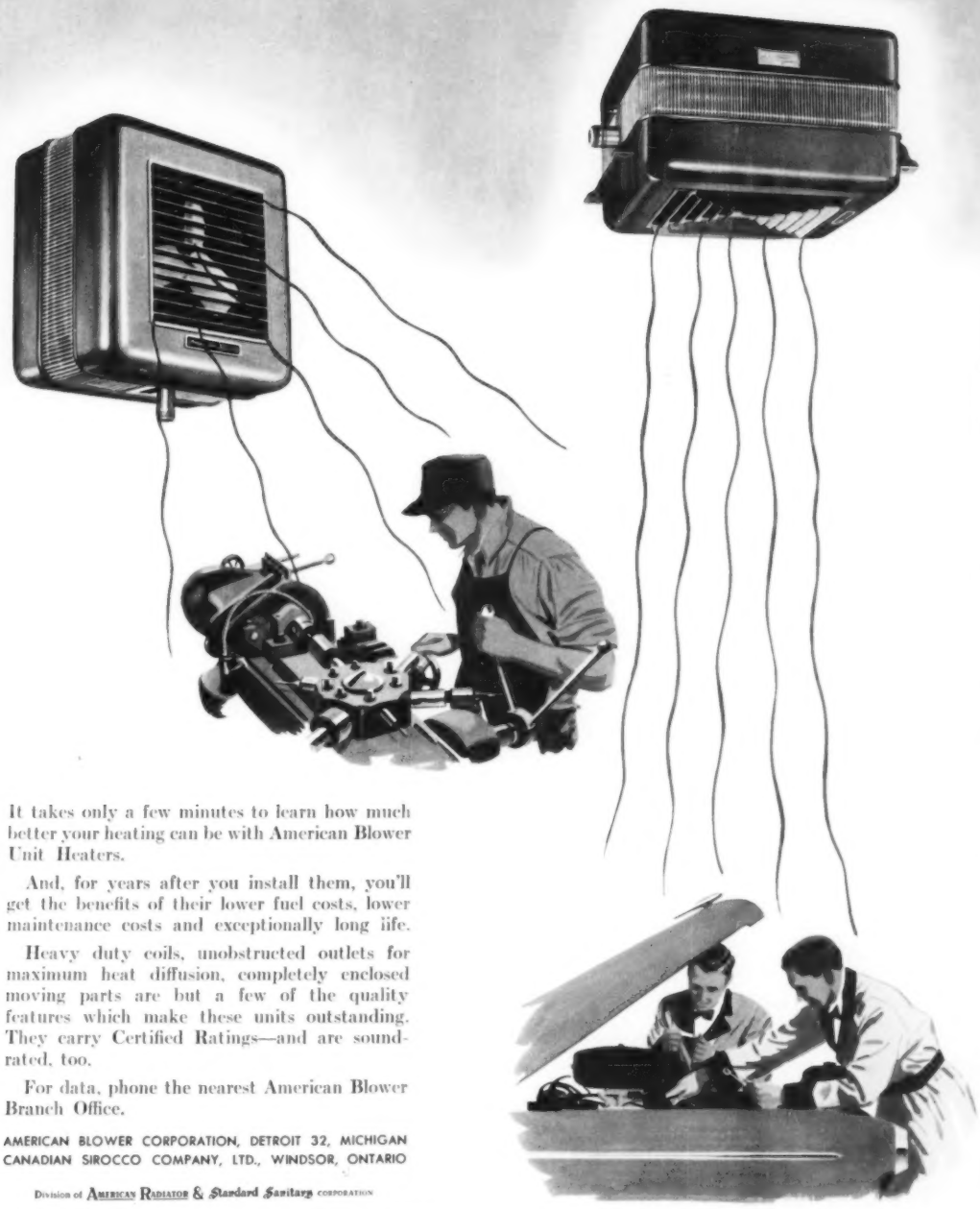
If you have motor service problems, phone or write to any of Century's 28 District offices regarding Century's national network of service stations—the motor exchange plan will serve you whether your motors are in or out of warranty.

Specify Century Motorized Equipment—get top equipment performance—dependable quiet service—keep your customers satisfied.

CENTURY ELECTRIC CO
1806 Pine Street • St. Lo

Century C MOTORS

American Blower – a time-honored name in air handling



It takes only a few minutes to learn how much better your heating can be with American Blower Unit Heaters.

And, for years after you install them, you'll get the benefits of their lower fuel costs, lower maintenance costs and exceptionally long life.

Heavy duty coils, unobstructed outlets for maximum heat diffusion, completely enclosed moving parts are but a few of the quality features which make these units outstanding. They carry Certified Ratings—and are soundrated, too.

For data, phone the nearest American Blower Branch Office.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

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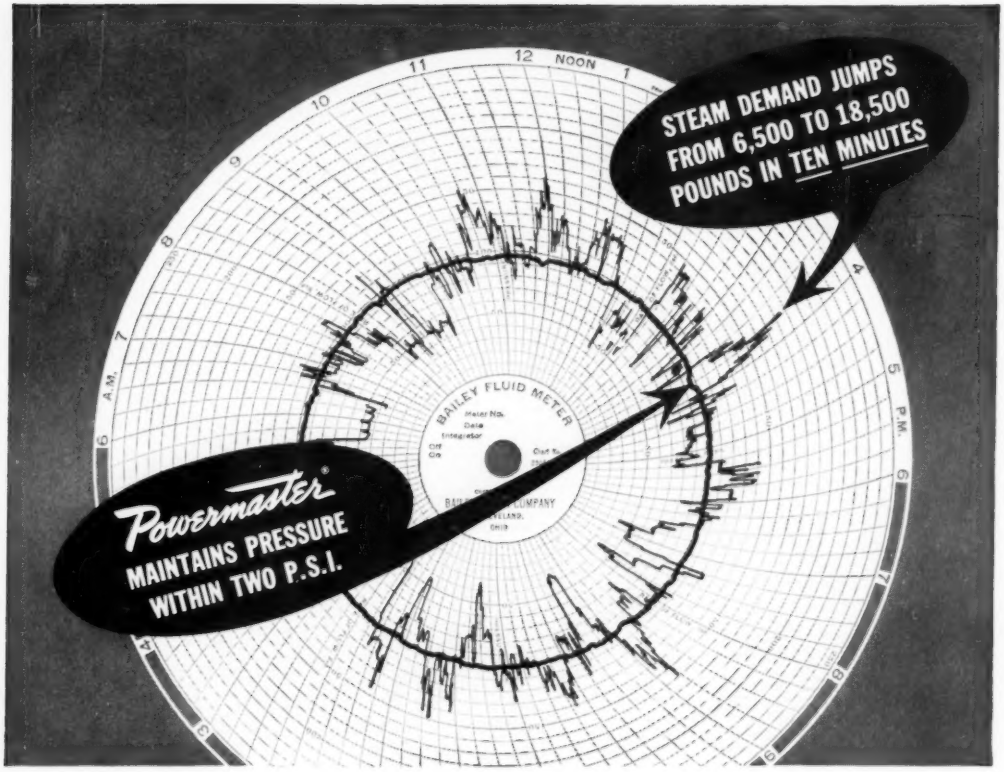
AMERICAN BLOWER

YOUR BEST BUY IN AIR HANDLING EQUIPMENT

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • ACME CABINETS • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON



Performance records prove *Powermaster's* VORIFLOW combustion responds immediately to steam demand . . . and at full efficiency

At a large southern cotton mill, two 300 h.p. POWERMASTER boilers are generating steam 'round-the-clock at a constant pressure of 100 p.s.i. Note how evenly this pressure (blue line on chart) was maintained even though steam demand (red line) varied from a low of 3,000 pounds per hour to a high of more than 18,500. Between 3:30 P.M. and 3:40 P.M. the load nearly tripled . . . but the POWERMASTERS responded immediately with insignificant pressure change and no "hunting".

This kind of performance is possible because of POWERMASTER's exclusive VORIFLOW combustion. Here's what it will do for you:

1. Saves fuel by providing infinitely variable combustion modulation in response to demand—with *full efficiency*—through wide range from 30% to 100% of firing capacity.

This means elimination of waste and maintenance headaches because of incomplete combustion. The VORIFLOW air-atomizing oil burner does away with outmoded mechanical spinning devices, globules of wasted oil, and gummy cleaning problems. The VORIFLOW gas burner is an O&S pre-mix design equally efficient at all firing rates between 30% and 100% loads.

2. Slashes boiler maintenance costs.

The burner has *no* moving parts to wear out • There is *no* cup to clean daily • Routine cleaning of the burner once a month is sufficient • There is *no* burner vibration to throw adjustments "out of whack" • Parts are made of stainless steel, brass, and beryllium copper—they will last indefinitely.

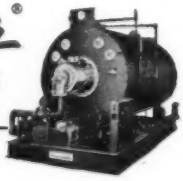
3. The combination burner permits rapid change-over from one fuel to another—light oil, heavy oil, or gas.

Before deciding on a boiler for your plant, be sure to get the facts on the newest POWERMASTER with VORIFLOW combustion. Write for this catalog that gives you the entire story of the *Powermaster* packaged automatic boiler. Just drop us a line and we'll put one in the mail for you.

Powermaster®

PACKAGED AUTOMATIC BOILERS

In sizes to 500 HP; pressures to 250 psi.



ORR & SEMBOWER, INC. • Established 1885 • **990 Morgantown Road, Reading, Pennsylvania**

HENRY

REALLY GIVES YOU SOMETHING EXTRA!

1 **RELIEF VALVES** diaphragm construction, positive controlled cushion reseating with relief capacity that meets latest code requirements.

2 **WING CAP VALVES** greater flow, bolted bonnet and self-aligning stem disc.

3 **PACKLESS VALVES** still the only Balanced-Action valve on the market—no extra cost.

4 **DRIERS** forged brass end caps with integral fittings, natural finish, Abso-Dry pressure sealed, dispersion tube and extra capacity.

5 **AMMONIA VALVES** compact and strong, self-aligning stem disc.

6 **STRAINERS** forged brass end caps with integral fittings, reinforced screen, large filtering area, distortion-proof clean-out flange.

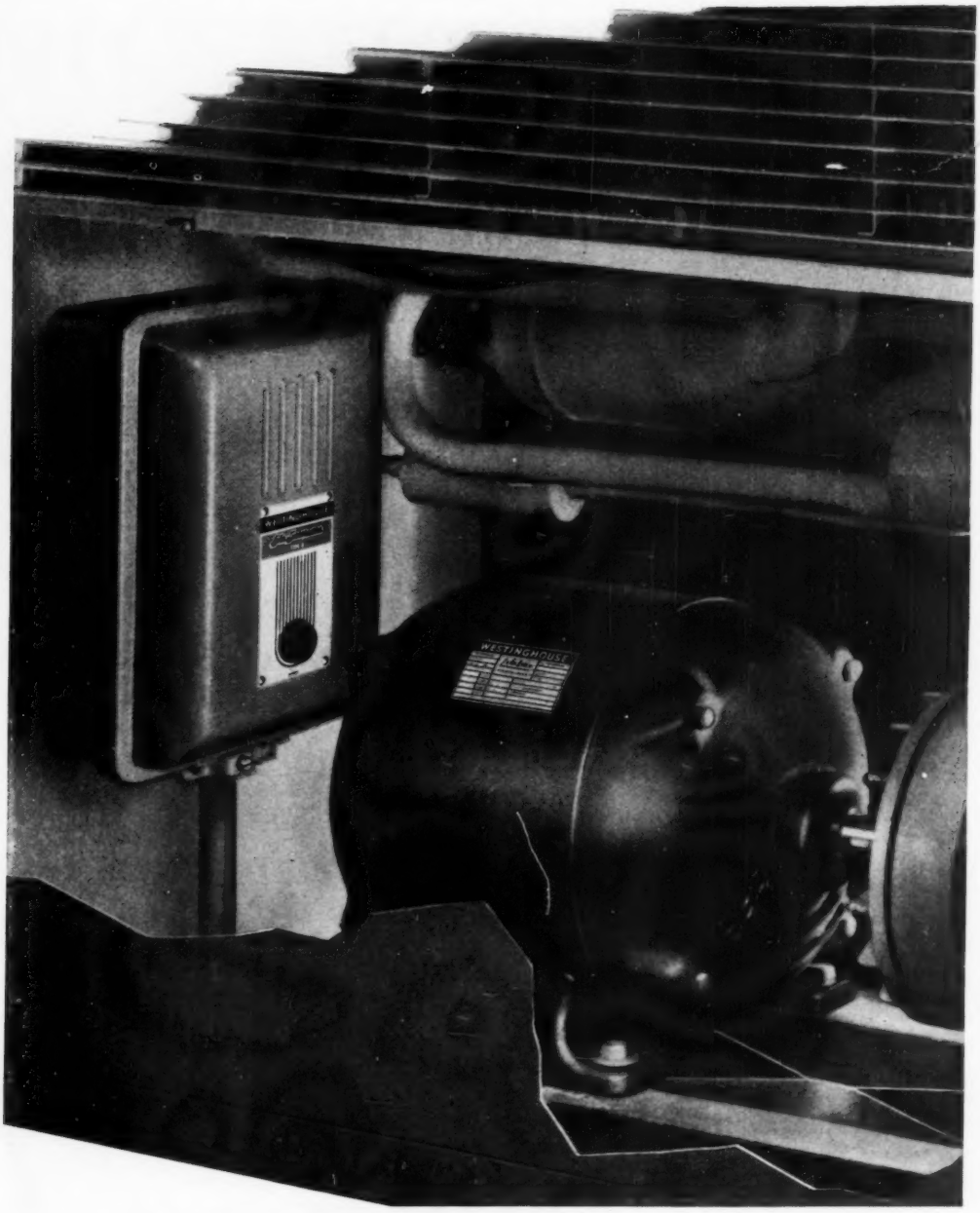
HENRY VALVE CO
CONTROLLING FLOW

Sold by Leading Wholesalers

HENRY VALVE CO.

Valves • Driers • Strainers • Control Devices and Accessories for Refrigeration, Air Conditioning and Industrial Applications

MELROSE PARK, ILL. (CHICAGO SUBURB)
CABLE: HEVALCO, MELROSE PARK, ILLINOIS



WHAT *Life-Lines* REALLY DELIVER IS MORE SERVICE...LESS SERVICING

So quiet you almost hear the temperature drop!

Air-conditioning equipment should be "felt", not "heard". That's where you get an important advantage with Life-Lines—quiet, vibration-free operation.

Take the smooth-running Life-Line motor. You can actually edge balance a coin on a Life-Line through a start, run, stop cycle. It's that smooth running! The reason? Instead of trying to dampen out noises that may exist, noises have been minimized through motor design, accuracy of manufacture and careful balancing of parts to avoid vibration. Quietness of operation is assured.

Unique starter design reduces electrical and mechanical noises to a new low. Important also is positive action of knife-edge bearing maintaining precise contact alignment. Here, too, quietness is assured.

Together, Life-Line motors and Life-Linestarters® offer you a new concept of motor and control performance. You get more service . . . with less servicing. Ask your Westinghouse representative for complete details on both, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21683

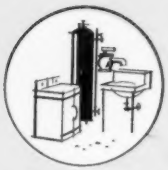
YOU CAN BE SURE...IF IT'S
Westinghouse
Life-Line
MOTORS and CONTROLS

Solved...3 of the biggest...

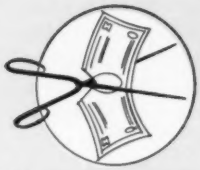
domestic hot water problems with

DETROIT *Vernatherm*® * water mixing valves!

1 Reduce water temperature from the heater to a usable temperature at the fixtures.



2 Make available hot water go farther, last longer.



3 Cut water heating costs.

Now, with DETROIT VD-203 and 205 Water Mixing Valves you'll find it easy to cash in on plenty of profitable new business! That's because these remarkable valves, employing the unique and highly sensitive Vernatherm Element, solve three of the biggest and most basic domestic hot water problems facing most homeowners today—and that includes literally hundreds of your prospective customers. What do these valves do? First, by mixing cold water with the hot water from the storage tank, easily installed DETROIT Vernatherm Valves automatically reduce the high storage water temperature from the heater to a usable temperature at the fixtures. In addition, due to this highly efficient and thrifty mixing operation, water is not wasted, as too hot, when a faucet is turned on. The homeowners' available hot water supply, therefore, not only goes farther and lasts longer, but pays off with savings—big savings on water heating costs. So take advantage of this outstanding sales opportunity. See your DETROIT wholesaler today or write direct to the factory for Bulletin No. A-167, giving complete information on time proven, long lasting, inexpensive and easy-to-work-with DETROIT Vernatherm Water Mixing Valves.

Stock and Sell these profitable Valves and cash in on what your customers want and need . . .

VD-203 (adjustable)
120°—165° F

VD-205 (non-adjustable)
135°—145° F

* Famous, time-proven Vernatherm, a thermostat employing a special power-creating substance highly sensitive to temperature variations, is the same element used by DETROIT in the manufacture of water mixing valves for automatic washing machines, commercial dishwashing machines, photographic developing machines, diesel, gasoline and jet engine thermostats, aircraft oil cooler controls, and transmission oil cooler controls.

DETROIT

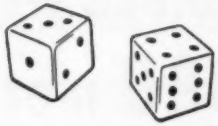
LUBRICATOR COMPANY

5900 TRUMBULL AVE., DETROIT 8, MICHIGAN
REPRESENTATIVES IN PRINCIPAL CITIES
Division of American Radiator & Standard Sanitary Corporation
RAILWAY & ENGINEERING SPECIALTIES, LTD.
Canadian Representatives in Montreal, Toronto, Winnipeg

DETROIT HEATING AND REFRIGERATION CONTROLS • ENGINE SAFETY CONTROLS • FLOAT VALVES AND OIL BURNER EQUIPMENT • DETROIT EXPANSION VALVES AND REFRIGERATION ACCESSORIES • STATIONARY AND LOCOMOTIVE LUBRICATORS

Serving home and industry

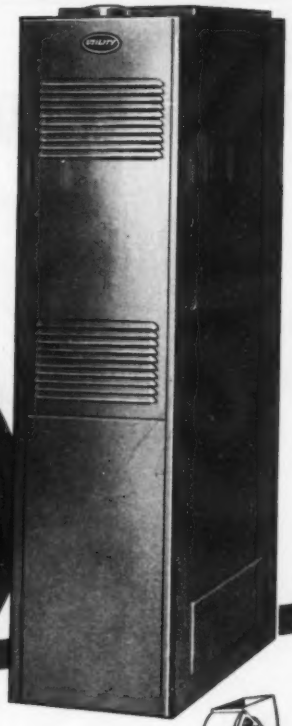
AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS · DETROIT LUBRICATOR · KEWANEE BOILERS · ROSS HEATER · TONAWANDA IRON



IT'S A NATURAL!

UTILITY'S NE

100



Let the chips fall your way!

Why gamble with ordinary heating equipment when you've got a *natural* winner with Utility's newly-developed 100FA Forced Air Furnace! The 100FA is the big brother of the sensationally successful Utility 70FA. And the 100FA should be just as popular with your customers for the same reasons: Extremely high heating performance (100,000 BTU input) at an unbelievably low price—luxury *forced air* heating for no more than ordinary installations. The 100FA will be popular with *you*, too, because its lower price lets you underbid competition profitably, lets you increase your net through lower installation costs and fewer costly call-backs. Send for FREE information today. Start pulling in the chips *now* on new and replacement sales with the easy-selling, profit-making Utility 100FA! AGA approved for zero clearance...uses only 19" x 25½" floor space.

BY-REKT® DRIVE BLOWER
—Constantly variable speed blower control permits correct air flow for any installation, without belts or pulleys.

SY-LENT® HEAT EXCHANGER
—Exclusive with Utility... allows for heat expansion and contraction without the "cracking" sounds so annoying to home owners.

Guaranteed Heating Performance

UTILITY
TRADE MARK

SEE THE COMPLETE UTILITY LINE TODAY AT YOUR DEALER'S!

Blowers

Air Coolers

Automatic Gas Ranges

DELIVERIES NOW!

UTILITY APPLIANCE CORP. C-852
4851 S. Alameda St., Los Angeles 58, Calif.

Please send me FREE information about Utility's new 100FA Forced Air Furnace and the *complete* Utility line.

Name _____

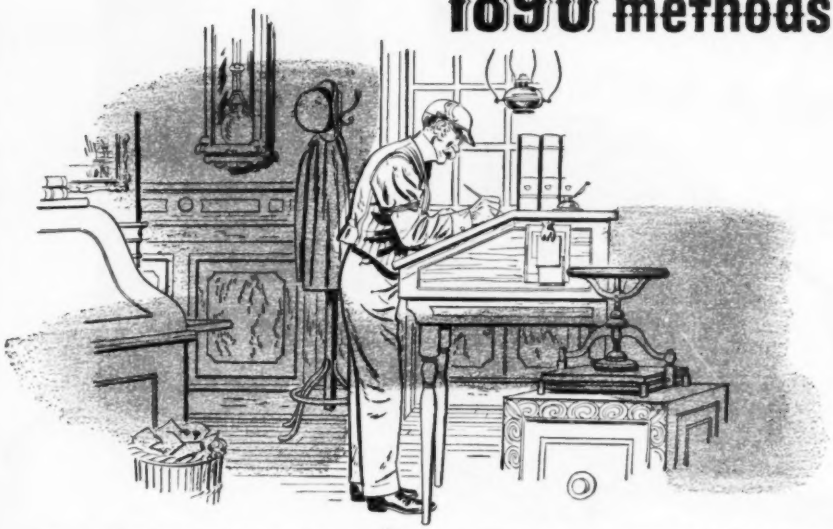
Address _____

City _____ Zone _____ State _____

UTILITY APPLIANCE CORP. 4851 South Alameda Street, Los Angeles 58, Calif.

MANUFACTURERS OF AIR COOLERS, BLOWERS, GAFFERS & SATTLER AND OCCIDENTAL AUTOMATIC GAS RANGES

Imagine doing business with 1890 methods!



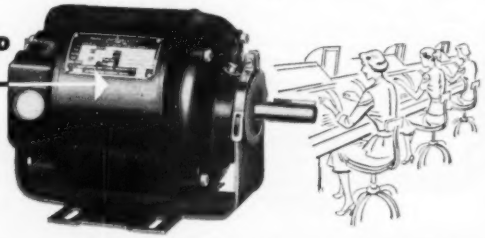
The bookkeeper with his eye shade and sleeve garters, at a high top desk, typified the tempo of business in the Gay 90's. His was a tedious and exacting job. Motorized equipment such as adding machines, calculators, bookkeeping machines, tabulating machines, postage meters, and letter openers, to name a few, were still in the future.

During this period Emerson-Electric was founded. Since then motors have been supplied to scores of leading manufacturers of labor-saving devices.

They staked the reputation of their products on Emerson-Electric motors, and with the passing years became nationally known for dependable service.

Consider this 62-year-old reputation for dependability and efficiency, earned by Emerson-Electric motors for use in business, on the farm, in the home and in industry. Your inquiry is invited on the complete line of standard motors in horsepower ratings from 1/20 to 5, and hermetic motor parts 1/8 to 10 H.P.

MODERN BUSINESS **IS POWERED WITH** ELECTRIC MOTORS



Write for these Emerson-Electric Motor Data Bulletins

Manufacturers requiring motors 1/20 to 5 h.p. can profitably use these reference guides. Specifications, construction and performance data are included for these motors:

- ☐ M132-A Capacitor-Start
- ☐ M132-B Split-Phase
- ☐ M132-C Integral
- ☐ M132-D Fan-Duty
- ☐ M132-E Oil-Burner
- ☐ M132-F Jet Pump
- ☐ M132-G Blower

THE EMERSON ELECTRIC MFG. CO., St. Louis 21, Mo.

EMERSON ELECTRIC
MOTORS • FANS — APPLIANCES

LEADERS IN THE FAN AND MOTOR INDUSTRY SINCE 1890

There's no REAL substitute for

CHASE® COPPER WATER TUBE

For hot and cold water lines

Why risk a substitute when you know you just can't beat Chase Copper Water Tube for domestic hot and cold water lines! Chase Copper Water Tube will not clog with rust. For new construction use Chase Type L, hard temper, and Chase solder-joint fittings. Available in 20 foot straight lengths hard or soft temper. Type L, soft temper, also comes in 40 foot, 60 foot and 100 foot coils that can be snaked behind walls and under flooring.

For underground piping

Look at all the advantages in using Chase Type K Copper Water Tube soft temper, for underground piping! It is so ductile it can be bent around rocks and obstructions. Settling won't harm it as it moves with the earth. Chase Copper Water Tube comes in coils in lengths up to 100 feet. This means fewer fitting connections. All Chase Copper Water Tube is readily bent and cut.

Chase® BRASS & COPPER

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

• *The Nation's Headquarters for Brass & Copper*

Albany†	Chicago	Hanover†	Kansas City, Mo.	Newark	Pittsburgh	San Francisco
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Baltimore	Cleveland	Hartford†	Milwaukee	New York	Rochester†	Waterbury
Boston	Dallas	Indianapolis	Minneapolis	Philadelphia	St. Louis	(Tube sales only)

THE REMOTAIRE
by AMERICAN-Standard

Ideal for new construction or modernization of hotels, motels, office buildings, hospitals, schools, apartments, and residences. Permits individual weather control for each room.

● **THE REMOTAIRE** is designed for summer cooling and winter heating for multi-room installations. Individual control of each unit allows the occupant to choose the room temperature that suits him best without affecting adjoining spaces.

Chilled or heated water is supplied to the Remotaire through a simple piping system from a remotely located central water chiller and heating plant. Designed for location under windows, the Remotaire can be free standing or recessed into wall 4 inches.

The Remotaire is provided with an arrangement for introducing ventilation air through a wall aperture. However, ventilation air may be supplied by several other methods if desired.

Installation of the Remotaire is easy and simple. For descriptive literature on this new remote type room air conditioner, including dimensions and ratings, write for Form 298.

Design provides low cost installation . . . efficient performance . . . and minimum maintenance

1. . . . four standard control packages are available.

2. . . . coil is designed for either right or left hand connections and can be easily reversed in the field if necessary.

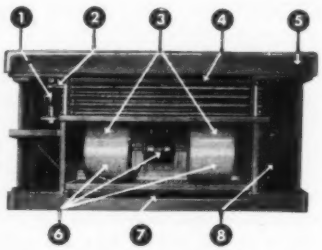
3. . . . exceptionally quiet with low speed fans and acoustically-treated air passages.

4. . . . coil shield over the top of the coil prevents foreign matter from falling into coil. Should liquid be spilled in air grille, the coil shield will safely carry liquid into drain so it will not injure unit or room floor nor interfere with operation of the Remotaire.

5. . . . rugged cabinet construction of sturdy, reinforced, furniture steel—plus a reinforced air grille—adds to permanence and long-lasting beauty of unit.

6. . . . fans and motor on single mounting plate permit easy removal if necessary.

7. . . . room ventilation can be adjusted —either manually or can be automatically operated—with the fresh air damper located in each unit.



8. . . . spacious end compartments with removable end panels provide ease of installation and allow more than 90° horizontal wrench swing.

American Radiator & Standard Sanitary Corporation, Dept. HP-82, Pittsburgh 30, Pa.

AMERICAN-Standard
HEATING-COOLING

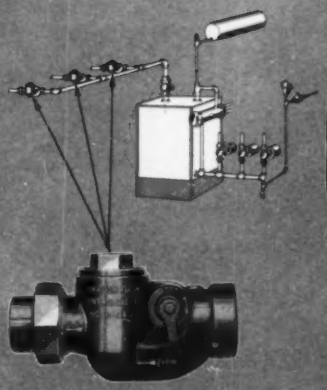
Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

New Units for '52

HELP YOU PROVIDE BETTER HOT WATER HEAT

more conveniently and economically



HORIZONTAL
Thrush Flow Control Valve

Ideal for zoning modern homes. Give more headroom in low basements, save pipe. Simplify installation. Three sizes —1", 1¼", 1½" (with unions). ½" tapping for venting. Handy lever for raising seat disc to drain system or for gravity circulation.

NEW NO. 46
SAFETY
Relief Valve
A.S.M.E. APPROVED

A water relief valve designed to serve double duty of relieving not only water but steam if critically high temperatures occur in a hot water heating system. Conforms to A.S.M.E. code. ⅜" inlet, 1" outlet.

3 NEW SIZES
Thrush Water Circulators

Low volume horizontal units for small heating plants. ¾", 1", and 1¼" sizes.

AN INCREASING number of smaller hot water heating systems are now being installed. The low water content of these systems requires small, low capacity circulators if "volume hum" is to be avoided. These new competitively priced small units enable you to do a better job at lower cost. Powered with ⅙ horsepower motors, with the same mechanical construction of the larger Thrush Circulators, and built-in lubrication, they will run quietly and smoothly for years. For information on the complete Thrush Flow Control System and other time-saving, money-saving hot water heating specialties, see your wholesaler or write Dept. E-8.

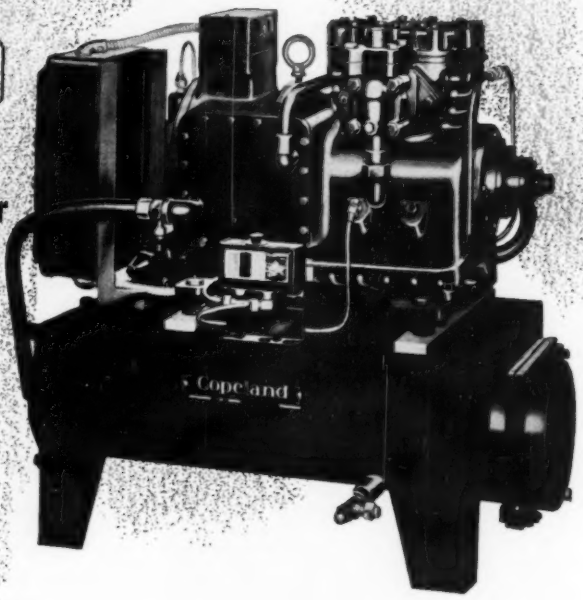
H. A. THRUSH & COMPANY
PERU • INDIANA

THRUSH

FORCED CIRCULATING FLOW CONTROL HOT WATER HEAT

COPELAMETIC

THE *Accessible* HERMETIC



condensing units and motor-compressors for all air conditioning requirements

- ☑ COMPACT
- ☑ ECONOMICAL
- ☑ DEPENDABLE
- ☑ RUGGED
- ☑ QUIET

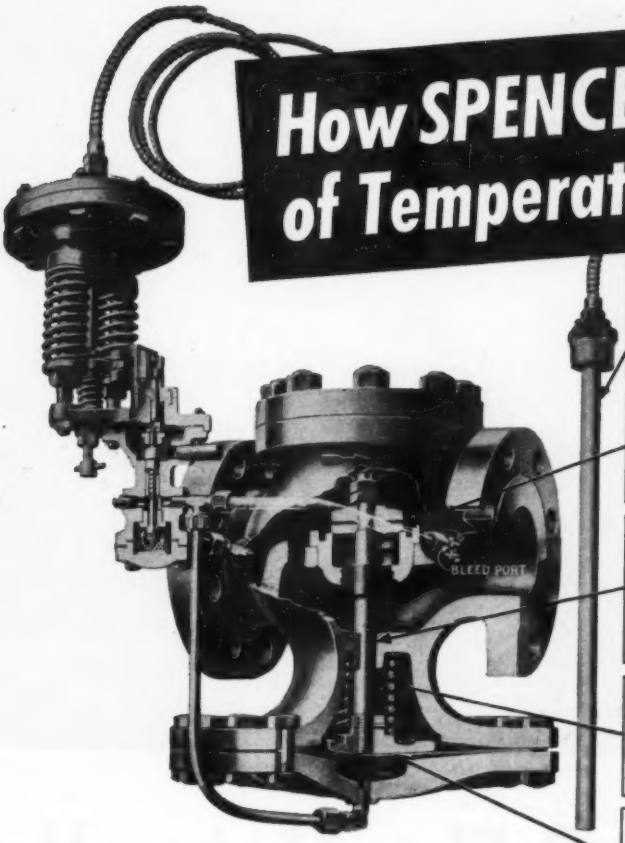
Copelametic is as modern as air conditioning itself. Its advanced design neatly combines the best qualities of open-type and welded-in units into one compact package. No belts, no seals, no manual oiling. It is fully accessible when the rare occasion arises.

And the Copelametic is just one star performer in our dependable line. There is a rugged Copeland unit for every application in refrigeration and air conditioning. Sizes through 7½ H.P. Write today for complete data.

Copeland
DEPENDABLE *Electric* REFRIGERATION

COPELAND REFRIGERATION CORPORATION, SIDNEY, OHIO

How SPENCE Cuts Costs of Temperature Control



NEW THERMOSTAT ELEMENT—Improved to practically eliminate loss of filling. Rugged construction; cannot be injured by overheating.

SECO METAL—Seats and discs are made of SECO Metal—guaranteed not to wire-draw.

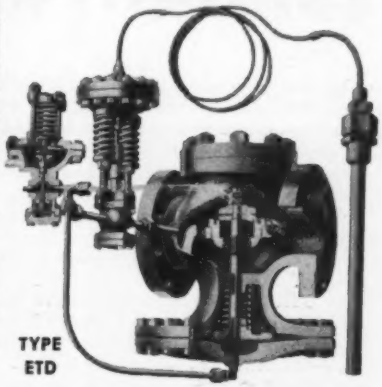
PACKLESS CONSTRUCTION — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

PROTECTED SPRINGS — Springs in the Spence Regulator are out of the path of the steam or other fluid flowing through the valve.

LARGE BALANCED DIAPHRAGM— Spence metal diaphragms, under usual conditions, never require replacement.

Accurate Control for Both Storage and Instantaneous Heaters

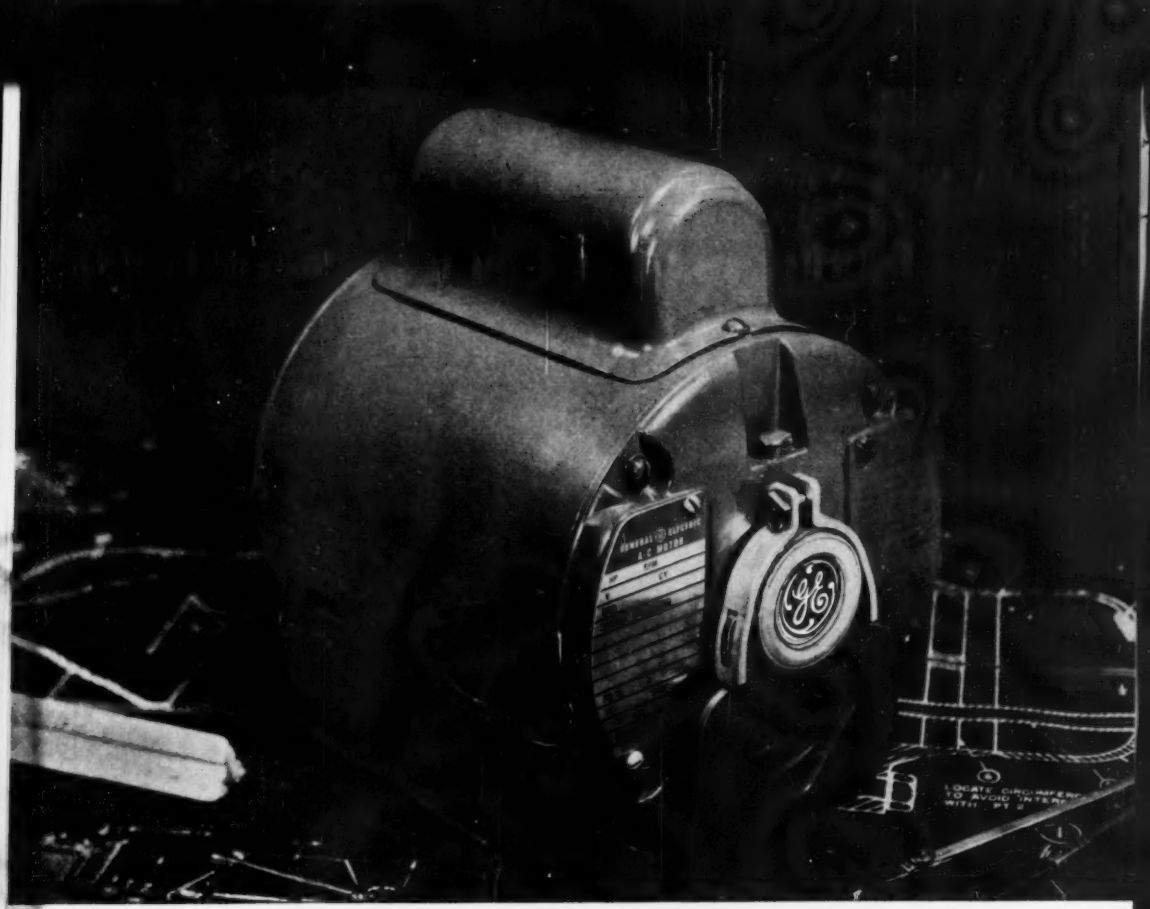
Spence Temperature Regulators reduce the steam pressure and also accurately modulate the flow as required to control the temperature. No separate reducing valve is necessary • The Spence ET150 Regulator is recommended for heater pressures up to 50 psi. For higher pressures the Type ETD is available • For complete details on the entire Spence line of automatic regulating valves, strainers and desuperheaters, write for Bulletin 1200.



TYPE ETD

Spence

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK



All-new G-E Fhp Motor Has

What *does* industry want in a motor? Smaller size? Lighter weight? More versatility? Functional design? They're all here . . . in the new Form G motor! Yes, and *full NEMA performance, too!*

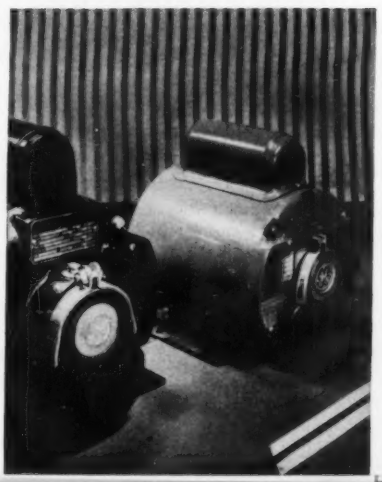
Smaller size makes product improvement possible despite critical material shortages. Lighter weight cuts shipping, installation costs, means easier handling.

Versatile, all-angle sleeve-bearings mean a general-purpose motor can replace more costly specials.

Clean-cut, functional design packs maximum power in minimum space. There's room on your product for motor improvement. Ask your G-E Sales Engineer to explain the details of the most sweeping advance in motor history . . . the new Form G fractional!

Write for bulletin GEA-5567 for a full description. *Section 700-120, General Electric Co., Schenectady 5, N. Y.*

SMALLER . . .



GENERAL ELECTRIC

ALL NEW! Shaft to shell, new motor completely redesigned, functional, no waste space.

TOUGH! New nylon insulation, braidless neoprene leads withstand insulation hazards.

QUIET! Magnetic noise cut by permanently fixed stator punchings, and new rotor design.

LONG LASTING! Switch, terminal board in shell, not in end-shield: prevents lead-damage.

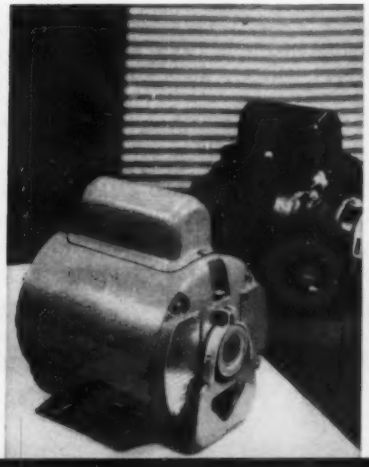
EASY TO USE! Terminal box cover plate shows connections inside, lubrication outside.

FLEXIBLE! Operates shaft up, down, any position. Cradle base allows rotation of motor.

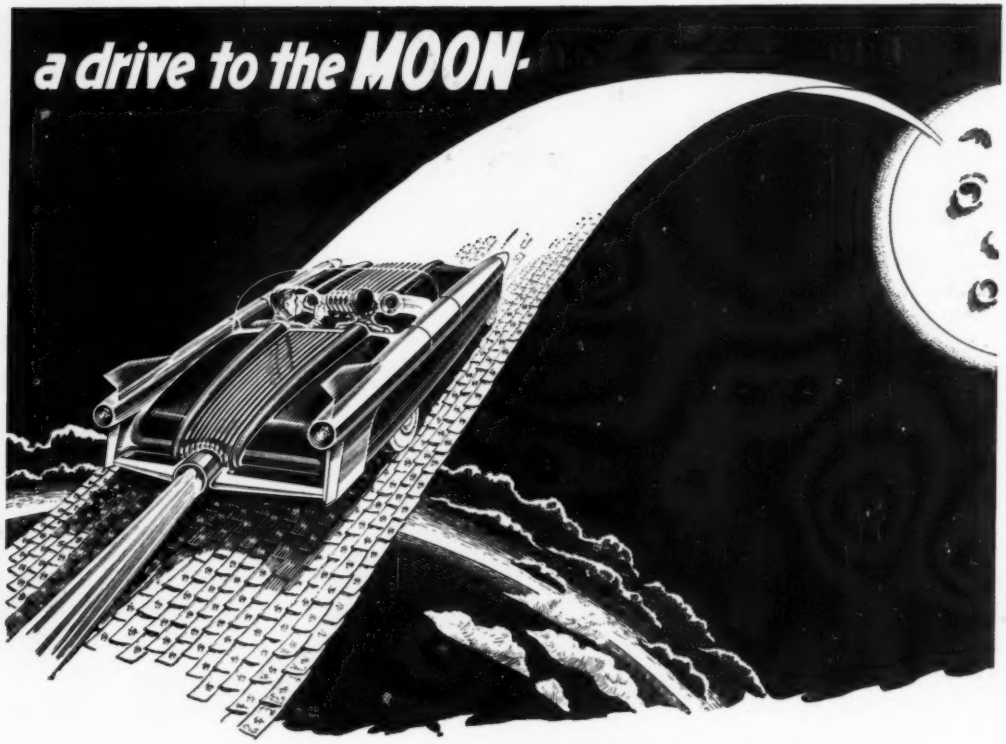
Everything Industry Wants!

LIGHTER . . .

BETTER LOOKING . . .



MORE VERSATILE!



On a road paved with YOUR Dollars

A road twenty feet wide, carpeted with one dollar bills, extending 256,471 miles through space to the moon,--illustrates the astronomical magnitude of our Federal debt.

1932 was a bad year for most of us, whether we were in business, or looking for a job, or going to school.

1952 seems much better to the majority of our citizens, with increased business, high wages and a good education for the children.

But how much better off, really, are those of us who think "we're in clover"? Consider our National debt which has skyrocketed from 19 billion dollars to over 260 billion dollars in the past twenty years.

Such a figure is difficult to grasp. But it represents your debt, the amount that you and your family must pay. This debt is the obligation of every man, woman and child in the United States. The interest on this debt must be paid through taxes, and as the debt increases, the more our taxes will increase. If you have a wife and two children, your share of the Federal debt is now approximately $7,000.

Your debt is now 13 times what it was in 1932, and they're planning right now, down in Washington, to inflate it even more.

Do you like it? Is that what you want? If you don't like it and don't want further expansion of our Federal debt, it's up to you to let Washington know. Only when American citizens are aroused and speak up, by electing able and patriotic men to public office, will there be an end to this orgy of public extravagance.

YOUR SCRAP IS NEEDED — YOUNGSTOWN

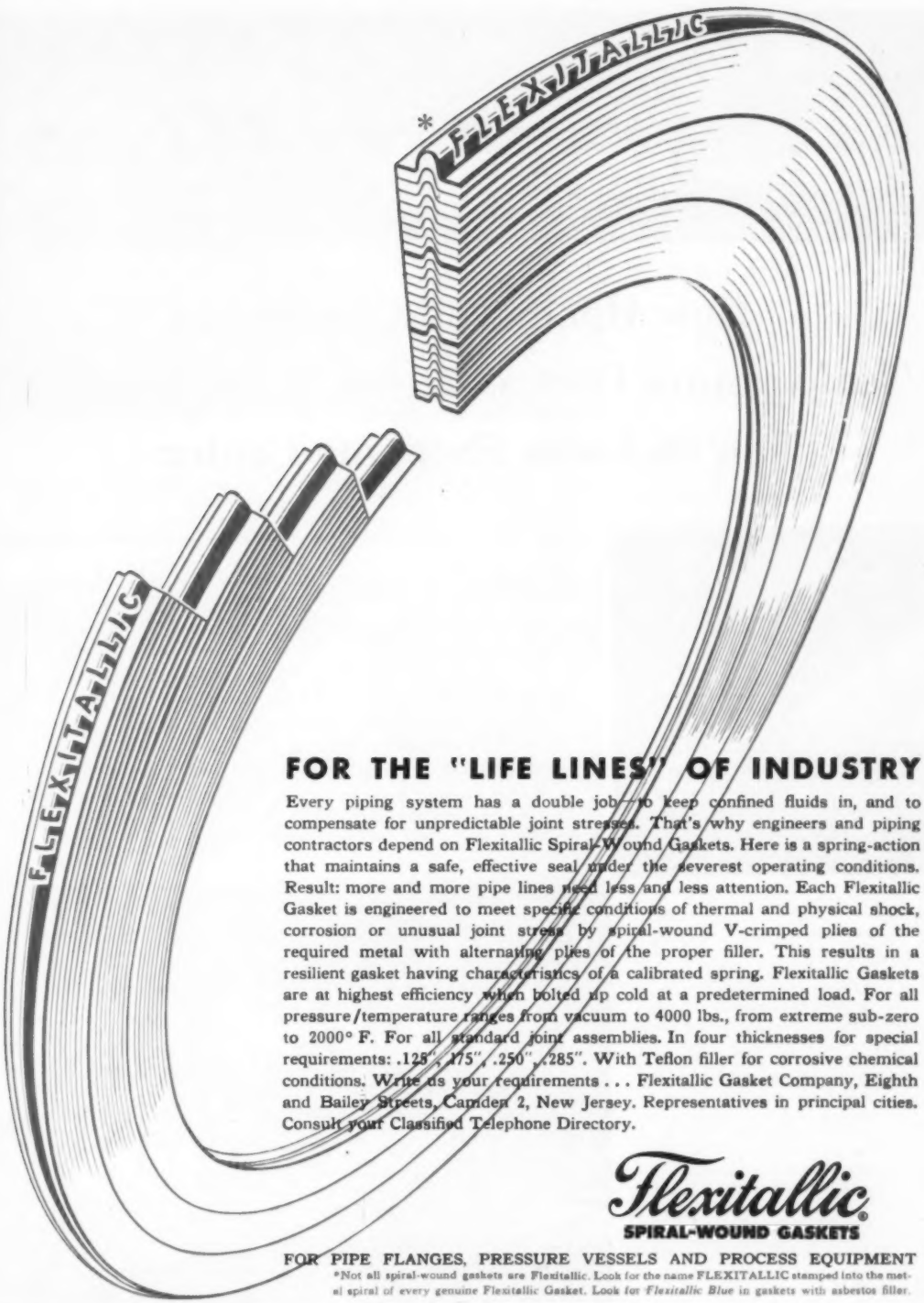
The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio

Export Offices--500 Fifth Avenue, New York

MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

The steel industry is using all its resources to produce more steel, but it needs your help and needs it now. Turn in your scrap, through your regular sources, at the earliest possible moment.



FOR THE "LIFE LINES" OF INDUSTRY

Every piping system has a double job—to keep confined fluids in, and to compensate for unpredictable joint stresses. That's why engineers and piping contractors depend on Flexitallic Spiral-Wound Gaskets. Here is a spring-action that maintains a safe, effective seal under the severest operating conditions. Result: more and more pipe lines need less and less attention. Each Flexitallic Gasket is engineered to meet specific conditions of thermal and physical shock, corrosion or unusual joint stress by spiral-wound V-crimped plies of the required metal with alternating plies of the proper filler. This results in a resilient gasket having characteristics of a calibrated spring. Flexitallic Gaskets are at highest efficiency when bolted up cold at a predetermined load. For all pressure/temperature ranges from vacuum to 4000 lbs., from extreme sub-zero to 2000° F. For all standard joint assemblies. In four thicknesses for special requirements: .125", .175", .250", .285". With Teflon filler for corrosive chemical conditions. Write us your requirements . . . Flexitallic Gasket Company, Eighth and Bailey Streets, Camden 2, New Jersey. Representatives in principal cities. Consult your Classified Telephone Directory.

Flexitallic®
SPIRAL-WOUND GASKETS

FOR PIPE FLANGES, PRESSURE VESSELS AND PROCESS EQUIPMENT

*Not all spiral-wound gaskets are Flexitallic. Look for the name FLEXITALLIC stamped into the metal spiral of every genuine Flexitallic Gasket. Look for *Flexitallic Blue* in gaskets with asbestos filler.

How Honeywell Customized Temperature Control Helps Boost Business in St. Louis Shopping Center

Year 'round comfort—winter and summer—keeps customers coming back.

The Hampton Village Shopping Center, located in St. Louis, Missouri, is one of the most progressive community retail operations in the country.

Plenty of parking space, the convenience of nighttime shopping, smart, efficient store interiors—these are some of the reasons why.

And another reason for Hampton Village's success has to do with the superior kind of *comfort* the center's customers and employees enjoy.

For at Hampton Village, air conditioning and heating plants give *maximum* comfort—because they're controlled by Honeywell Customized Temperature Control to meet differences in exposure, occupancy and use.

As store managers at the center have learned, it's important to furnish customers with an ideal "climate." Because *comfortable* customers keep coming back—and come back more often.

Temperature control problems resulting from exposure are illustrated by the above view of Hampton Village's Medical Center-Shopping area, designed by St. Louis architect Preston J. Bradshaw. The S. S. Kresge store, facing west, absorbs a great deal of sun on hot summer afternoons. The J. C. Penney store (interior, right), with a large glass area to the north, is vulnerable to cold wintry winds. But with Honeywell Customized Temperature Control on guard—neither store is ever uncomfortable.

Separate thermostat systems are located in each ground floor shop in the Medical Center building. Thus, the management of shops like Garland's, above, can maintain the exact temperatures that will please customers and employees. And Honeywell Customized Temperature Control—with a separate thermostat controlling each of several fan units—enables doctors located on the second floor to provide the temperatures their patients find most comfortable.

Exposure and occupancy problems are of first importance in the world-famous Bettendorf Market, above. Floor space is vast, to take care of peak customer load. The building, located in the center of the big parking area, is exposed on all sides to sun and wind. Yet, with Honeywell Customized Temperature Control on the job—with thermostats located strategically throughout the store—Bettendorf customers and employees enjoy an ideal "climate" at *all* times.

For comfortable, even temperature in new or existing buildings—of any size—specify Honeywell Customized Temperature Control

Whether it's a store, office, factory, school, garage—or any size building—new or existing—Honeywell Customized Temperature Control can meet your clients' heating and ventilating problems.

Once equipped with Honeywell Customized Temperature Control, they'll have the right kind of controls to keep their employees, customers and tenants comfortable—and they'll save fuel besides.

For complete facts on Honeywell Customized Temperature Control, call your local Honeywell Office. There are 96 across the nation. Or mail the coupon today.

"It's proved the importance of comfort," says Robert W. Shepard, vice-president of Webb and Knapp, Inc., owners of Hampton Village Shopping Center.

"With the kind of comfort Honeywell Customized Temperature Control helps make possible at Hampton Village, the 'regular' customer list grows constantly. And our maintenance department has had very little trouble."

MINNEAPOLIS-HONEYWELL REGULATOR CO.
Dept. HA-8-178, Minneapolis 8, Minnesota

Gentlemen:

I'm interested in learning more about Honeywell Customized Temperature Control.

Name_____

Firm Name_____

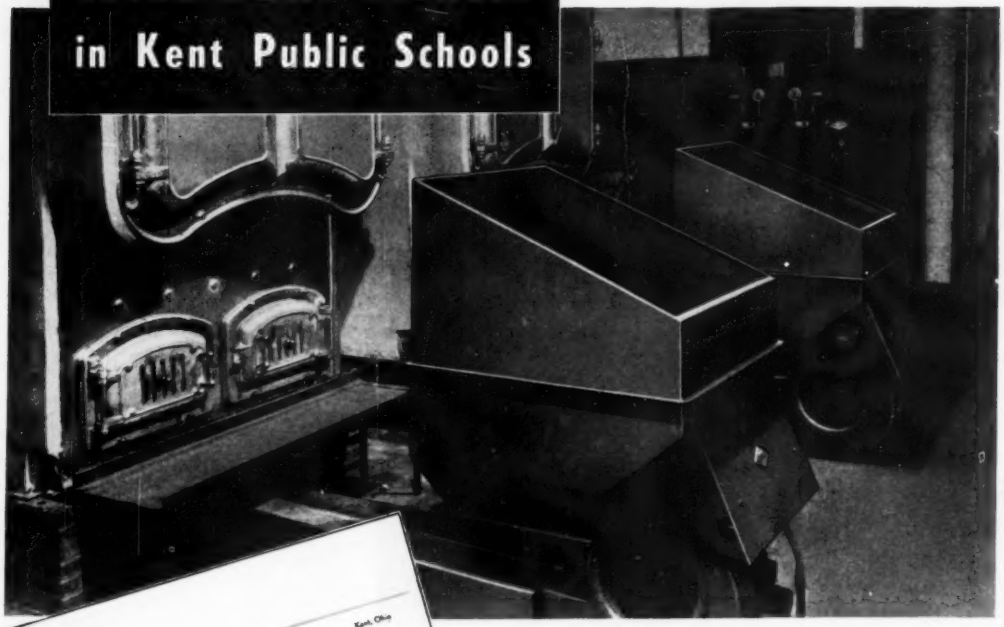
Address_____

City_____ Zone____ State_____

MINNEAPOLIS
Honeywell

First in Controls

An A+ for WILL-BURT stokers in Kent Public Schools



KENT PUBLIC SCHOOLS

H. P. Smith, Superintendent — Kent, Ohio

Will-Burt Stoker Company
Orrville
Ohio

Gentlemen:

I wish to tell you how pleased we are with our Will-Burt stoker equipment. We have had one unit in an elementary building for ten years with no trouble. Another elementary installation of three years has functioned perfectly. The dual stokers installed in our Roosevelt building in the Fall of 1950 have done well. We are proud of this installation and recommend Will-Burt to all interested in stoker equipment.

Cordially yours,

H. P. Smith
Superintendent

Since the original Will-Burt installation many years ago, Kent (Ohio) Public Schools have installed three additional Will-Burt stokers. The latest, a dual installation at Roosevelt High School, is shown above.

Why were Will-Burt stokers specified each time? Because they had proved their economy . . . trouble-free operation . . . and year-in year-out dependable performance. Yes, if stokers were rated like students, there'd be a big A+ for Will-Burt at the Kent Public Schools.

Engineers and contractors have found it pays to specify Will-Burt. More good words from the customer — paving the way to future jobs.

Write today for facts on the Will-Burt line.

WILL-BURT

THE WILL-BURT COMPANY

DEPARTMENT H ORRVILLE, OHIO

STOKERS • RESIDENTIAL BOILERS • OIL AND GAS CONVERSION BURNERS

AIR AS CLEAN AS YOU LIKE IT.
AAF
Dust Dollars and Dividends
A brief discussion of:
The ever present air borne scourge which has beset mankind throughout the ages.
The recoverable dollars, it has cost us an impediment to production—comfort, cleanliness and health!
The dividends to be earned by its scientific control.
All of which adds up to what
American Air Filter
has done in the development of dust control equipment which makes Clean Air, available in unlimited volume to factories, hospitals, schools, stores and homes the world over.

for Executives and Consultants...

AAF now offers this new book, "Dust, Dollars and Dividends". With case histories and illustrations it tells the dramatic story of air pollution, the problems it creates in our economy, and their profitable solution.

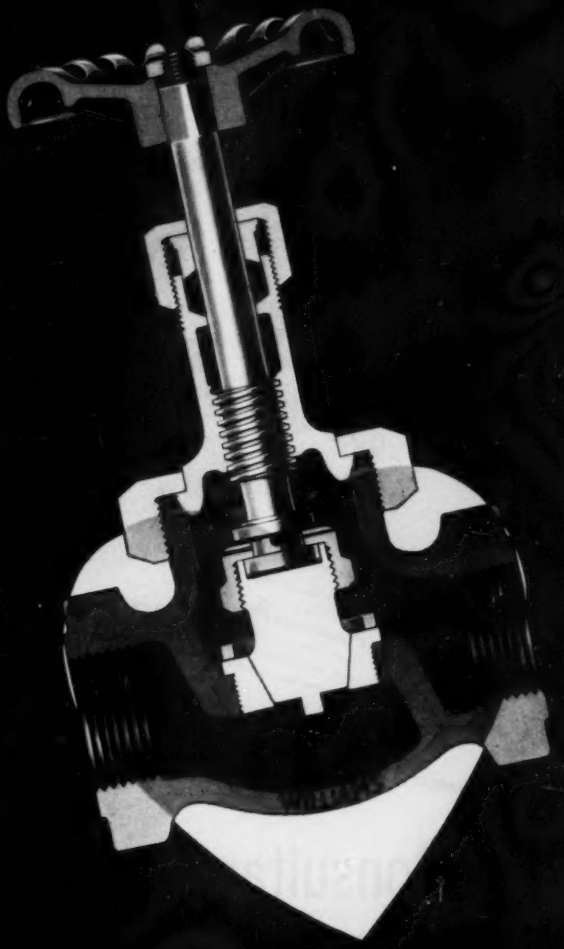
Write us today for your *free* copy.

American Air Filter
COMPANY, INC.
215 Central Avenue, Louisville 8, Ky.
American Air Filter of Canada, Ltd., Montreal, P. Q.
Pacific Division Office, San Francisco, California

American Air Filter Company, Inc. H
215 Central Avenue
Louisville 8, Kentucky

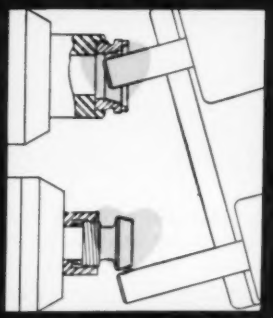
Please send me your new booklet "Dust, Dollars and Dividends" . . . the dramatic story of dust, its problems and their profitable solution.

NAME_____
TITLE_____
COMPANY_____
CITY_____ STATE_____

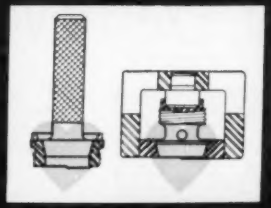


THERE'S ACCURACY IN THE HEART OF EVERY D. T. WILLIAMS VALVE

Assured by simultaneous machining of disc and seat ring . . .



then precision gauge inspection!



See your nearest jobber or write for literature

D.T. Williams VALVES
GUARDIANS OF THE PIPELINES

THE D. T. WILLIAMS VALVE CO.
Founded 1904
Division of The Schaible Company
SUMMER STREET • CINCINNATI 4, OHIO

new in '32

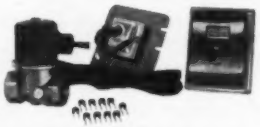
still better today

Improved K3-A Solenoid Gas Valve...

Quiet—Dependable—Hi-Capacity—

Soft Seat—For All Gases—

Way back in 1932, the forebear of the present K3-A was originated, developed and pioneered by General Controls. It became the first in a long series of quiet, dependable, two-wire solenoid magnetic gas valves that today are standard equipment at home and in industry for controlling gas to warm air furnaces, gas-fired boilers, conversion burners and similar applications. Closing with the gas flow, in the K3-A the pressure is on the top of the soft seat assuring indefinitely tight valve shut-off. Closing is automatic in case of power failure, and the K3-A, like all other General Controls solenoids, is absolutely humless when energized. Current consumption is low and the extremely compact valve easily meets high flow capacities and operating pressure requirements. In the K3-A you find just one more sound reason why the leaders everywhere declare that for the best in *automatic* controls, it's General Controls!



T-30 PACKAGE SET

For automatic heat at home, the General Controls T-30 Package Set is a sure short cut to economical and trouble-free comfort. Included with the graceful T-70 Timer Thermostat, is the long-proved, Type K3 Magnetic Gas Valve, Transformer and Thermostat Cable. Optional Timer Thermostat is furnished in two models, either for internal night setting (T-70-T) or with both day and night temperature selection at your finger tip (T-70-X) on the face of the sleek and satin-finished cover.

GENERAL CONTROLS

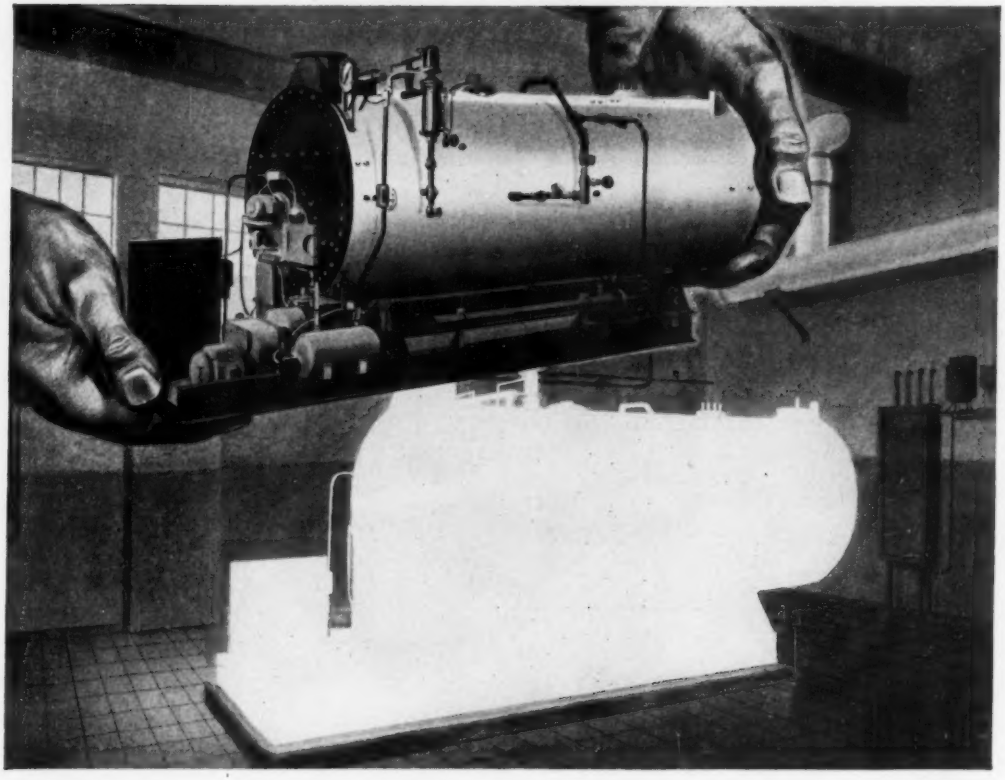
801 ALLEN AVENUE GLENDALE 1, CALIFORNIA

Manufacturers of Automatic Pressure, Temperature, Level and Flow Controls

FACTORY BRANCHES: Baltimore 5, Birmingham 3, Boston 16, Buffalo 3, Chicago 5, Cleveland 15, Columbus 15, Dallas 2, Denver 4, Detroit 21, El Paso, Glendale 1, Houston 6, Indianapolis 4, Kansas City 2, Milwaukee 3, Minneapolis 2, Newark 6, New Orleans, New York 17, Omaha 2, Philadelphia 23, Pittsburgh 22, St. Louis 3, San Francisco 7, Seattle 1, Tulsa 6, Washington 6, D.C.

DISTRIBUTORS IN PRINCIPAL CITIES

Ready when you need it...



Save Installation-Construction Time — Expedite Emergency Installations — Serve Immediate Temporary Steam Needs — With a Cleaver-Brooks Self-Contained Boiler

WHEN speed is vital, you can save weeks of valuable installation time with a Cleaver-Brooks boiler — delivered to location as a complete, factory assembled and tested, self-contained unit, with much of the trim and accessories provided.

In an emergency the installation time can be reduced to as little as 48 hours, by following a properly planned and coordinated procedure of providing in advance the required facilities — foundations, headers, service and blow-off lines, fuel tanks and lines.

Prior to the completion of your building, Cleaver-Brooks boilers can be placed in operation to serve immediate steam needs. When permanently installed the change-over takes place with a minimum of labor and expense and the avoidance of interrupted steam service.

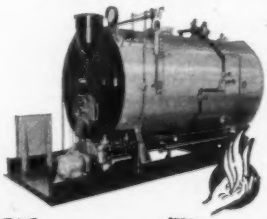
Cleaver-Brooks are the first and finest in modern, self-contained boilers — operate at a guaranteed efficiency of 80% — burn the fuel most available and economical in your area, gas, oil, or combination gas and oil — fully meet all codes — standard models available in sizes 15 to 500 hp; 15 to 250 psi.

CLEAVER-BROOKS COMPANY
Originators of the Self-Contained Boiler
312 E. Keefe Ave., Milwaukee 12, Wis., U.S.A.
Cable Address: Clebro-Milwaukeewis
Dept. J.

Write for latest, fully illustrated and descriptive Cleaver-Brooks Steam Boiler Catalog.

WHY INSTALLATION TIME IS CUT:

- Simple Low-Cost Stack
- No Job-Site Brickwork — No Special Foundations
- Boiler Delivered as a Complete, Factory Assembled, Tested, Self-Contained Unit
- Centralized Responsibility — No Waiting on Multiple Sources of Supply



Cleaver-Brooks

Builders of Equipment for the Generation and Utilization of Heat • Steam Boilers • Oil and Bitumen Tank-Car Heaters • Distillation Equipment • Oil and Gas-Fired Conversion Burners

Architects:
PIROLA & ERBACH

Mechanical Engineer:
JOSEPH P. BAZZONI

Heating Contractors:
WACHOLZ HEATING CO.

St. Monica Parish

Marsh equipped

Reproduced above is an architectural rendering of St. Monica Parish which combines a stately church and modern school now nearing completion in Chicago.

Marsh Valves and Traps were specified for the well-designed heating system — a logical choice for a building executed in the tradition in which no effort is spared that can contribute to permanence.

The selection of Marsh equipment for St. Monica Parish is one more example of the preference accorded Marsh heating specialties for important buildings everywhere.

Ask for catalog 76-H covering all Marsh heating specialties.

Marsh Packless Radiator Valves and Marsh Thermostatic Radiator Traps were used throughout the St. Monica heating system.

The Marsh No. 12 float and thermostatic trap is typical of many Marsh traps used in the St. Monica installation.

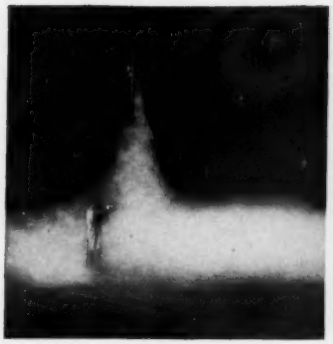
MARSH HEATING EQUIPMENT CO. *Sales affiliate of Jas. P. Marsh Corporation*
Dept. T, Skokie, Ill.

MARSH

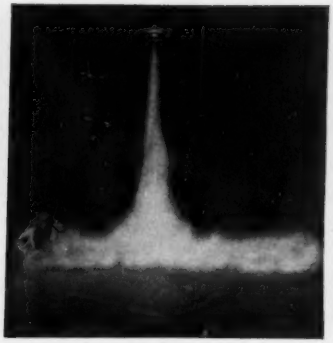
Heating Specialties Since 1865

GAUGES • THERMOMETERS • WATER REGULATING VALVES • SOLENOID VALVES

See how TRANE unit



Projection Heater without diffuser sends ceiling heat to floor.

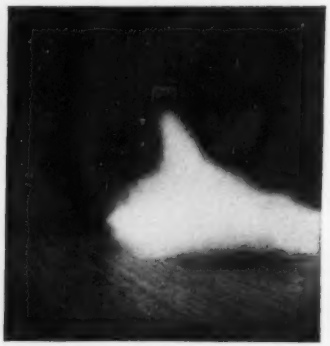


Straight-down stream with patented Louver Cone gives 60% extra throw.

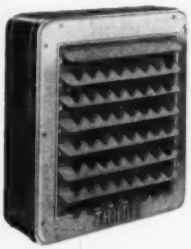
Here Louver Cone forces heat down and floods it over a wider area.

Horizontal Unit Heater with Louver Fin diffuses heat in gentle blanket.

Here heat stream is "split"; thus one unit does the work of two heaters.



Louver Fin blades "toed-in" for spot heating, add up to 25% more throw.



TRANE Model H Unit Heater—Versatile horizontal-type heater with exclusive Louver Fin Diffuser.

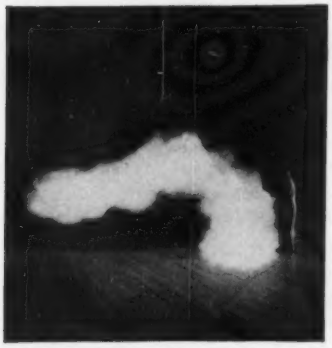
TRANE Projection Heater with exclusive Louver Cone Diffuser. Projects ceiling heat to floor.

TRANE Roof Ventilator—Also available with heating section and dampers.

MANUFACTURING ENGINEERS OF HEATING, VENTILATING AND

heaters deliver heat where it's wanted...

Louver Cone "spots" heat on one side, warms area without waste.

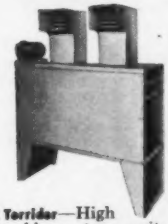


Half of heat flows ahead; balance is delivered at right angle.

IN THESE smoke tests you can see how TRANE Unit Heaters put the right *amount* of heat . . . right *where* you want it. And these are only *two* unit heaters from the complete TRANE line. You can actually choose from *six different models*, in dozens of sizes, to handle any heating problem.

For instance, the TRANE Projection Heater is ideal for high ceiling installations . . . and craneways, aisles and bays. For heavy-duty heating jobs in one big area or with duct work, use the TRANE Torridor. Ventilation problems are simplified with a powered TRANE Ventilating Heater. There's the TRANE Force-Flo Heater for lobbies and offices . . . and the TRANE Horizontal Unit Heater for heating smaller rooms. Or if gas is available, use the all-new TRANE Gas Fired Unit Heater. It's the most rugged gas unit heater ever built.

These six TRANE Unit Heaters, together with two patented diffusers, give you the *right combination* for any unit heater application. See your nearest TRANE sales engineer for details, or write TRANE, La Crosse, Wisconsin.



TRANE Torridor—High volume blower-type unit; available in 5 models.

New TRANE Gas Unit Heater
Built like a boiler; 6 sizes.

TRANE Force-Flo Heater—Deluxe, powerful cabinet-type heater.

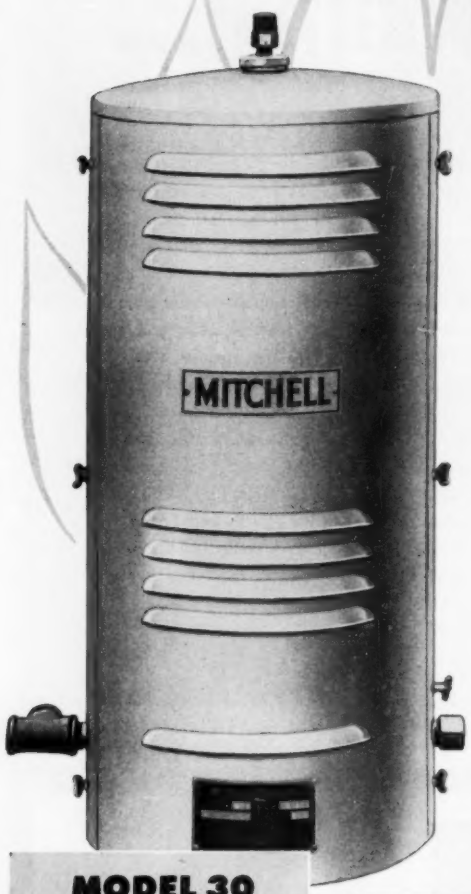
TRANE Bucket and Float Traps—Matched for perfect service with TRANE Unit Heaters; for either high or low pressure.

TRANE

THE TRANE COMPANY, LA CROSSE, WIS.
Eastern Mfg. Division, Scranton, Pa.
Trane Company of Canada, Ltd. . . . Toronto
Offices in 80 U.S. and 14 Canadian Cities

AIR CONDITIONING EQUIPMENT

Specify MITCHELL vaporizers for BUTANE-PROPANE INSTALLATIONS



MODEL 30

MITCHELL Vaporizer

Capacity—30 gallons per hour (rated input—30,000 BTU per hour). Other models from 2 to 280 gallons per hour.

Underwriters Listed!

Tells how the MITCHELL Vaporizer is installed . . . how it's used . . . address JOHN E. MITCHELL COMPANY, 3800 Commerce St., DALLAS, TEXAS.

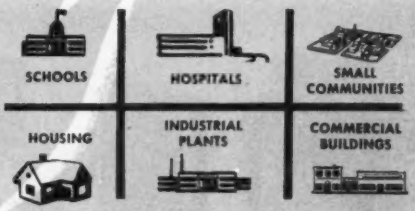
WRITE FOR FREE BOOKLET

PREVENTS FREEZE-UPS DUE TO TEMPORARY OVERLOADS OR LARGE WITHDRAWALS

When you are designing systems for butane-propane, think of MITCHELL Vaporizers for constant gas supply in precise response to demand.

By patented Automatic Selective Control, a MITCHELL Vaporizer safely provides reliable butane-propane gas supply without danger of freeze-ups due to temporary overloads or large withdrawals.

Get the facts on MITCHELL Vaporizers . . . let our Engineering Department supply you with complete information for any specific installation on which you are working.



JOHN E. MITCHELL COMPANY

Manufacturers of Fine Machinery for more than Forty-Five Years

DALLAS, TEXAS

ANOTHER EXAMPLE OF VERSATILITY...

10 DRAVO *Counterflo* HEATERS

PROVIDE COMPLETE HEATING AND VENTILATING FOR HOMESTEAD VALVE PLANT, AT CORAOPOLIS, PENNA.

Homestead Valve Manufacturing Company, makers of Hypressure Jenny Steam Cleaning Units, uses Dravo *Counterflo* Heaters three ways at its Coraopolis, Penna., plant.

1. TEMPERING MAKE-UP AIR

Pickling, washing, drying, painting, welding and testing create contaminated and unpleasant air conditions. Two Dravo Heaters supply 44,000 cu. ft. of tempered make-up air per minute for replacement of exhausted fume-laden air.

2. COMFORT HEATING

Eight Dravo Heaters maintain a 70° F. temperature throughout the 400 ft. x 100 ft. building which contains the plant, offices, lavatories and storage rooms. The choice of gas or oil as fuel guarantees warm working conditions in spite of occasional gas shortages in very cold weather.

3. SUMMERTIME VENTILATION

During hot spells, the heater fans circulate air throughout the building, thus keeping employes more comfortable.

DRAVO HEATERS OFFER YOU . . .

LOW INITIAL COST—Users report 30% to 60% savings over "wet-type" systems.

EASY INSTALLATION—Need only fuel, exhaust and electrical connections . . . no ductwork.

LOW OPERATING COST—Direct-fired . . . burn gas or oil . . . readily converted . . . minimum efficiency 80%.

AUTOMATIC OPERATION—On-off or modulating controls . . . no constant attention needed.

LONG SERVICE LIFE, LOW MAINTENANCE—Stainless steel combustion chamber eliminates refractory lining.

SAFETY—Approved by American Gas Association, listed by Underwriters' Laboratories, Inc.; Dravo standardized safety control circuit accepted by Factory Mutual Engineering Division.

MOBILITY—Can be moved to any location.

FLEXIBILITY—When floor space is limited, can be wall-hung or suspended from trusses in any position.

MAIL THIS COUPON FOR MORE INFORMATION . . .

DRAVO
CORPORATION

PITTSBURGH • ATLANTA • BOSTON • CHICAGO • CINCINNATI
CLEVELAND • DETROIT • NEW YORK • ST. LOUIS • PHILADELPHIA
WASHINGTON

Sales Representatives in Principal Cities

Manufactured and sold in Canada by Marine Industries, Ltd., Sorel, Quebec. Export Associates: Lynch, Wilde & Co., Washington 9, D.C.

Heating Department, Dravo Corporation
Dravo Building, Fifth and Liberty Avenues
Pittsburgh 22, Penna.

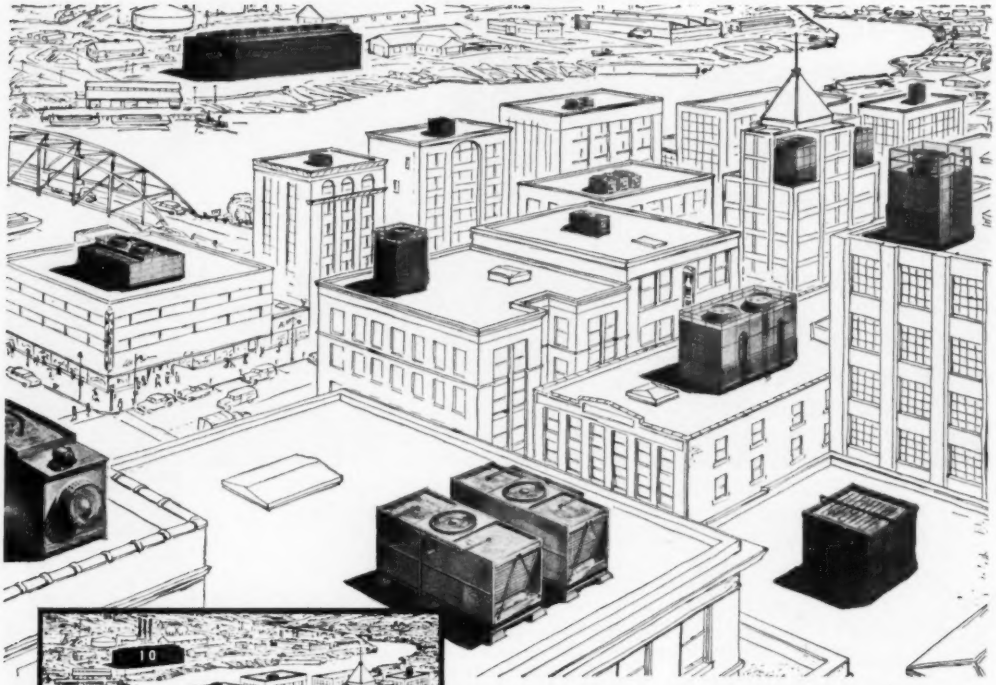
I would like more information about Dravo Counterflo Heaters. Please send me Bulletin No. EF-523-243

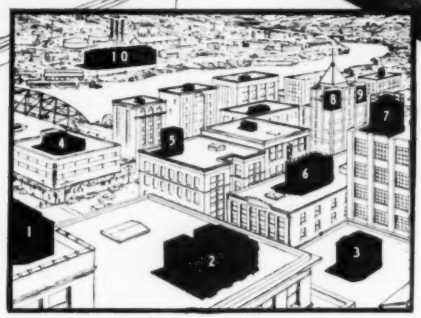
Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____





In every American City,

the "Marley Story"

is written on the skyline!

1—Aquatower*
2—Steel Double-Flow Aquatowers*
3—Natural Draft Tower
4 & 10—Double-Flow* Towers
5—Wood Conventional Tower
6—Steel Conventional Towers
7—Steel Series V Tower
8 & 9—Asbestos Board Cased Conventional Towers
*Registered Trade Names

What kind of cooling towers do air conditioning and refrigeration experts prefer above all others?

For your answer, simply glance out your office window and review the roof-tops of the buildings around you. On hotels and hot dog stands, atop department stores and dairies, on hospitals and homes, chances are, you'll see more Marley cooling towers than any other kind.

This is so because air conditioning and refrigeration contractors know that in the Marley line—the only *complete* line of water cooling towers—they will find the proper tower for the job at hand. They know that every Marley cooling tower is backed by 25 years of specialized water cooling engineering and production—and that every Marley tower will repay its cost many times over in water savings and trouble-free service.

For the complete Marley story, get in touch with you local Marley Application Engineer. He'll help you select the proper tower to meet your specifications—a tower designed, manufactured, and guaranteed by the world's leading producer of water cooling equipment.

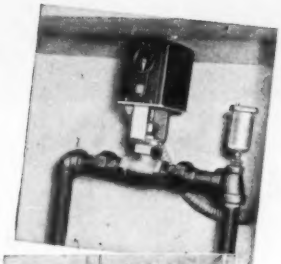
MARLEY

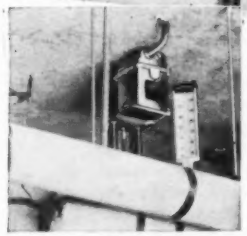
The Marley Company, Inc.

KANSAS CITY 5, MISSOURI

THE A B C OF PROPER *Automatic* TEMPERATURE CONTROL

OAKRIDGE SCHOOL, ARLINGTON, VIRGINIA
ARCHITECTS: Allen J. Dickey & John Graham, Jr. Arlington, Va. ENGINEER: A. Dee Counts. Washington, D.C. HEATING CONTRACTOR: W. J. Baumbach, Inc., Arlington, Va.





Above, Barber-Colman Motor-Operated Valve as installed on the hot water supply to each room.

Below, Barber-Colman Motor-Operated Valve on the steam supply to converter in the boiler room.

ALWAYS BARBER-COLMAN

THIS is *fundamental* with experienced heating and ventilating engineers: the A B C fact that Barber-Colman controls are at the top of the roll-call.

In the modern Oakridge School at Arlington, Virginia, Controls by Barber-Colman were installed to provide a good, efficient, heating and ventilating system with flexibility. Panels supply a steady, even flow of warmth with no drafts. Rooms are grouped by zones with a fan system in each zone to assure a constant flow of filtered, tempered air for ventilation and maximum comfort. Fans are shut down at night.

Water temperature, from the converter on the oil-fired steam boiler, is varied automatically by an outdoor reset thermostat. Individual room temperature is kept constant and over-runs avoided by use of anticipating thermostats and motor-operated valves. Since system supply water temperature varies with outdoor temperature, corridors are kept comfortable with minimum heat losses without use of valves and thermostats.

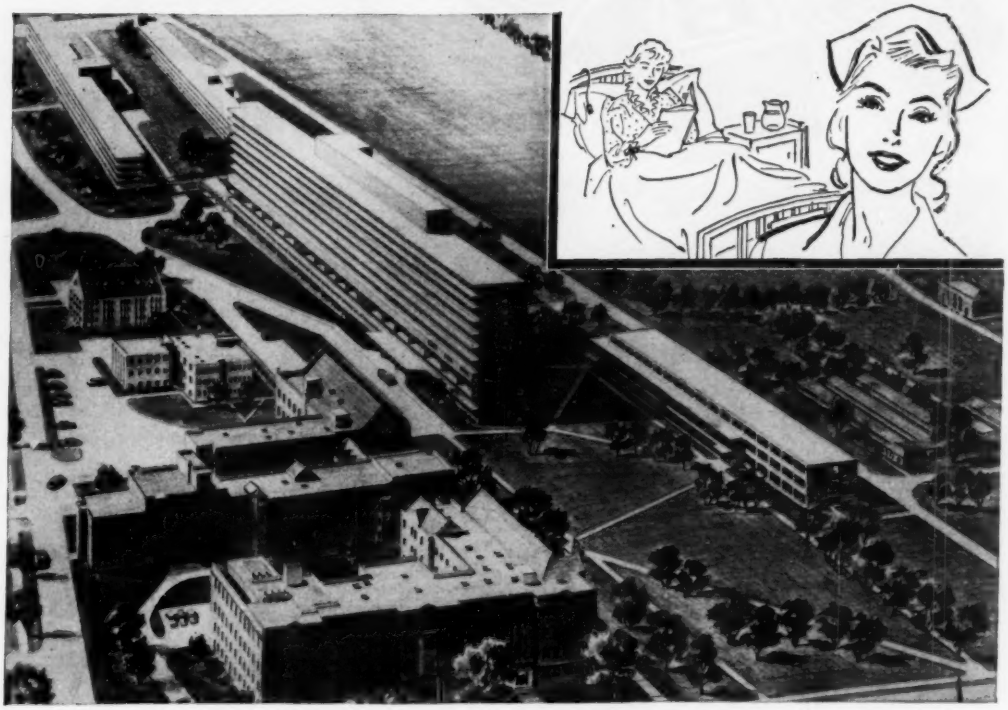
So, once again Barber-Colman Controls make possible a simple, cost-saving heating system. For detailed information on Barber-Colman Controls, write for Bulletin F-2287-3.

BARBER COLMAN

NATION-WIDE SALES AND ENGINEERING SERVICE

BARBER-COLMAN COMPANY, 1228 ROCK ST., ROCKFORD, ILL.

"The patient's doing nicely, thank you"



In this ultra-modern hospital

RADIANT HEATING

promotes comfort too!

How the "lady with a lamp," performing her errands of mercy, amidst crowded pallets of Crimean wounded, would have marvelled at the hospitals of today! To Florence Nightingale, the modern facilities for easing pain and suffering would have been unbelievable. And, *now,* even the therapeutic comforts of radiant panel heating contribute to the arts of healing!

As in this 11-story, 600-bed Ohio State University Medical Center, steel pipe radiant panel systems bring new conceptions of heating comfort to hospitals, institutions, schools, commercial and public buildings and, of course, modern new homes.

Steel pipe, more than any other, has made the large-scale application of radiant heating economically practical in any type of building; while the demonstrated performance capacity of steel pipe in hot water and steam heating systems, for more than 60 years, attests its complete reliability and durability in service. That's why steel pipe is first choice—the most widely used pipe in the world—for radiant panel heating!

Write for a copy. A free 48-page color booklet "Radiant Panel Heating with Steel Pipe"

Steel Pipe is First Choice

COMMITTEE ON STEEL PIPE RESEARCH
AMERICAN IRON AND STEEL INSTITUTE
350 Fifth Avenue, New York 1, N.Y.

STOP COIL BURN-OUTS!

You can safely install Alco Solenoid Valves in low temperature and high humidity rooms without worrying that moisture may cause coil failure.

The coils are impregnated with a special varnish that makes them moisture and corrosion resistant.

As a test, Alco Solenoids have been continuously operated under water for 18 months without breakdown!

Alco Solenoid Valves are tight seating, packless and quiet. You and your customers will like them.

Complete information on applications is given in our Bulletin 173. May we send you a copy?

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ALCO VALVE CO.

861 KINGSLAND AVE. • ST. LOUIS 5, MO.

Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.

5299

New IMPROVED
BRANFORD
UNIONS
• Precision machined—perfect alignment
• Ample wall thickness for rigid use
• Heavy bronze seat
• Full & accurate threads
• Clean bore—no recesses
• Individually tested and inspected
TAKE ONE . . . SHOOT IT YOURSELF!!
INDIVIDUALLY TESTED UNDER WATER AT 80 LBS. AIR PRESSURE
MIF
MALLEABLE IRON FITTINGS CO.
BRANFORD, CONNECTICUT

IMPROVED UNIONS

in a New Package*

QUALITY . . Tight joints, perfect threads and accurate machining assure concentricity and positive alignment.

DESIGN . . . . . Sturdy wall proportions resist severe usage.

MATERIAL . . Malleable iron with solid bronze seat guarantees superior service.

INSPECTION . . . Every union individually tested under water at 80 lbs. air pressure.

***This smart new package simplifies stocking and display. Instant positive identification provided by clear legible labels on *both* top and bottom.**

MIF

MALLEABLE IRON FITTINGS CO.

BRANFORD, CONNECTICUT

Remember the trade marks "tt" and "TUBE-TURN" are applicable only to products of TUBE TURNS, INC.

Streamline your purchase of welding fittings

Scrappy says, "Aid defense—more scrap today... more steel tomorrow."

Write Dept. A-8 for free booklet listing properties of pipe and welding fitting and flange materials.

JUST AS THE USE of welding fittings streamlines a piping system so does the standardizing on TUBE-TURN Welding Fittings streamline your purchasing operations.

The TUBE-TURN Welding Reducer, both in the concentric type shown here and the eccentric type, is available in a complete range of sizes, wall thicknesses and types of materials. This is another example of how the complete TUBE TURNS' line is designed to meet all your requirements. It covers over 4000 different items. Thus you can simplify ordering and deliveries for any piping job by obtaining all your welding fittings and flanges from one reliable source . . . your TUBE TURNS' Distributor. You'll find one in every principal city.

Be sure you see the double "tt"

TUBE TURNS, INC. LOUISVILLE 1, KENTUCKY

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Chicago • Houston • Tulsa • San Francisco • Los Angeles

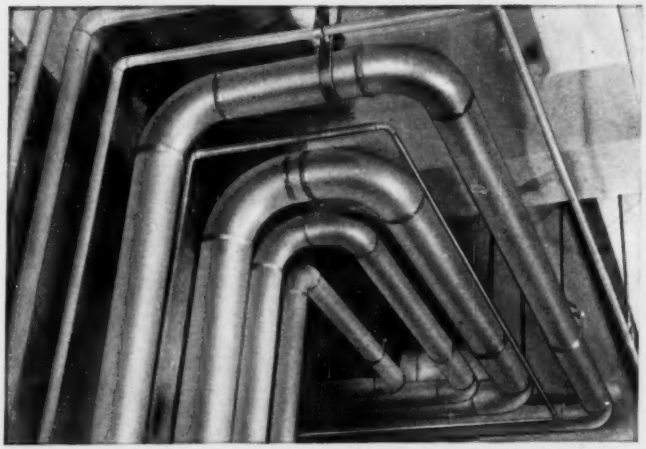
TUBE TURNS OF CANADA LIMITED, CHATHAM, ONTARIO... A wholly owned subsidiary of TUBE TURNS, INC.

30 Stories of New Building Ideas ...includes maintenance-free welded piping

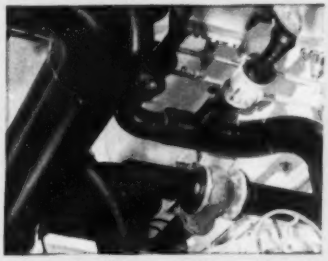
ALUMINUM COMPANY OF AMERICA'S new 30-story office building in Pittsburgh is a pacesetter for construction ideas. Exterior walls are made of sheet aluminum. Windows pivot on vertical axes to simplify cleaning. Radiant heating and cooling panels in ceilings increase rentable floor space.

In keeping with this progressive design, a welded piping system, using TUBE-TURN Welding Fittings and Flanges, was specified. Thus piping, both aluminum and steel, will be leak-proof and maintenance-free. The variety of welding-fitting requirements posed no problem, since TUBE TURNS, INC. offers the world's broadest line of welding fittings and flanges—available in a wide range of types, sizes, and more than 40 different metals and alloys.

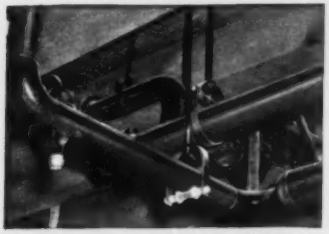
Alcoa's new office building. Architects: Harrison & Abramovitz. Assoc. Architects: Mitchell & Ritchey and Altenhof & Bown. Heating, Ventilating & Air Conditioning Sub-Contractors: Dravo Corp.; Plumbing Contractors: Sauer, Inc.



Corrosion-resistant aluminum lines for drinking, and hot and cold water supply saved critical copper. Note how welded lines, from 1" up, are fitted closely together, make for a neat installation. These lines will be insulated.



TUBE-TURN Welding Elbows, Tees, and Reducers used in steel piping for steam and hot water lines in basement. True circularity and uniform wall thickness of TUBE-TURN Welding Fittings expedited installation by insuring accurate fit.



Eight-inch steam line with 2" and 3" branches in fan room on roof. Use of welded system, with TUBE-TURN Welding Fittings, simplified piping design, gives streamlined appearance, eliminates maintenance problems.

TUBE TURNS, INC., Dept. A-8
224 East Broadway, Louisville 1, Kentucky

Your Name .....

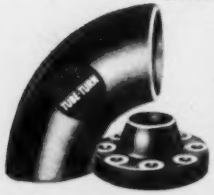
Position .....

Company .....

Nature of Business .....

Address .....

City ..... *State* .....



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TUBE TURNS, INC.

LOUISVILLE 1, KENTUCKY

Free Engineering Data

on BOILER FEED and CONDENSATE RETURN SYSTEMS

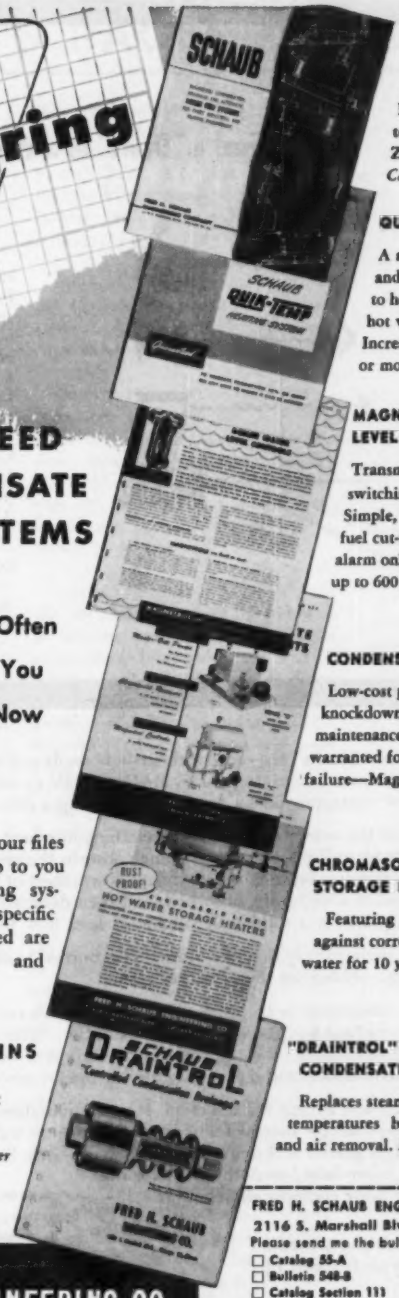
Information That is Often Hard to Find When You Need it . . . Get it Now and Keep it Handy

This information belongs in your files It will be of inestimable help to you when planning or specifying systems or components to do specific jobs most efficiently. Included are complete engineering data and specifications on:

ENGINEERING BULLETINS

"A Discussion of Deaerator Design Principles," covering design intent, basic requirements, and other considerations. *Engineering Bulletin 570.*

Engineering Notes for Storage Hot Water Heaters. How to determine the proper heater for specific applications. *Engineering Bulletin No. 911.*



ENGINEERED CONDENSATION DRAINAGE AND AUTOMATIC BOILER FEED SYSTEMS:

Standard boiler return systems—Pree-Heet Systems—Heat reclaim systems—Spray type deaerating systems—Zero oxygen deaerating systems. *Catalog 55-A.*

QUIK-TEMP HEATING SYSTEMS:

A method of continuous stream circulation and air removal that permits machines to heat almost instantly and keeps them hot with minimum effect from load change. Increases production potential 10% or more. *Bulletin 548-B*

MAGNETROL BOILER WATER LEVEL CONTROLS:

Transmits changes in water level to the switching mechanism by magnetic action. Simple, fool-proof, positive. May be used for fuel cut-off and alarm, cut-off only or alarm only. Models for all steam pressures up to 600 pounds. *Catalog Section 111.*

CONDENSATE RETURN SYSTEMS:

Low-cost prefabricated type and heavy duty knockdown type. Featuring Master-Bilt maintenance-free pumps—Chromasoid receivers, warranted for 10 years against internal corrosion failure—Magnetrol controls. *Bulletin 655.*

CHROMASOID LINED HOT WATER STORAGE HEATERS:

Featuring Chromasoid lined tanks guaranteed against corrosion failure from any kind of water for 10 years. *Bulletin 910.*

"DRAINTROL" FOR CONTROLLED CONDENSATION DRAINAGE:

Replaces steam traps. Enables higher surface temperatures by continuous condensation drainage and air removal. *Bulletin 642.*

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- ☐ Catalog 55-A
- ☐ Bulletin 548-B
- ☐ Catalog Section 111
- ☐ Engineering Bulletin 570
- ☐ Bulletin 655
- ☐ Bulletin 910
- ☐ Bulletin 642
- ☐ Engineering Bulletin 911

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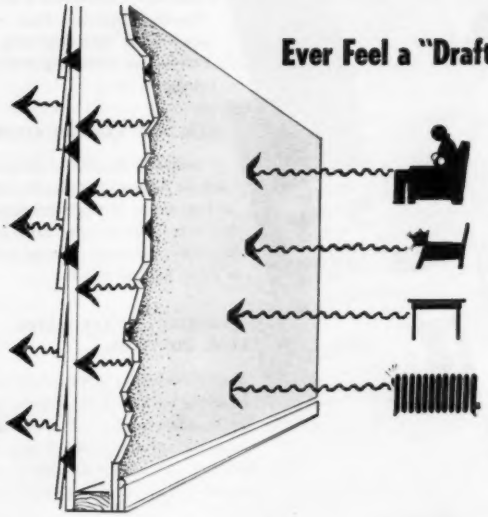

Ever Feel a "Draft" in a Warm, Closed Room?

(RADIATION is the transmission of rays through space. Infra-red heat rays travel at the speed of light, are invisible, have no temperature, only energy. But when absorbed by a surface, they are transformed to HEAT. The surface of any object warmer than absolute zero – the Sun, You, Clothing, Wood, Plaster, an Iceberg, a Stove, a Chair, Paper, an Animal, will RADIATE to a colder surface.)

(CONDUCTION is the process by which warmth flows from a warmer object or particle by direct physical CONTACT, to a cooler one.)

People often complain of "drafts" in a room with air-tight walls and windows. Why? To a large extent because, by Nature's law, warmth *flows* to cold by RADIATION as well as by CONDUCTION. Cold walls, too, draw heat out of contacting air by conduction, causing a downward current of cold air.

The exposed skin of people and the outer surfaces of their clothing lose heat as infra red heat rays flow from them, at a 90% rate, to a cooler wall plaster surface, which absorbs the rays at a 93% rate and transforms them again to heat. If insulation is lacking or has packed down, most of this heat is transmitted by radiation to the colder outer wall at a 93% rate, absorbed, and then dissipated to the colder, outer air. Ordinary insulation in the wall space, or a solid wall, augments heat flow by direct conduction.

So people are uncomfortable, perhaps only in spots. More fuel is burned to obtain greater comfort. Unnecessarily high, less wholesome temperatures result.

Multiple sheets of accordion aluminum in the wall space would block convection and reflect back 97% of heat rays to re-heat the plaster by their absorption. With plaster sufficiently warm, no heat radiates from bodies to walls. There is no current of cold air on the surface of the wall. Comfort is maintained without unduly high temperatures or fuel costs.

In summer, the process is identical except for direction. Heat by radiation, conduction and convection is retarded by the multiple sheets of aluminum in the outer wall space. The interiors of rooms stay cooler. Their plaster surfaces are cooler than the body. So, by Nature's law that warm radiates to cold, some heat *leaves* the body for the colder wall surfaces, increasing body coolness and comfort.

This discussion is amplified in Schwartz's "Simplified Physics of Vapor and Thermal Insulation."

The commercial form of multiple accordion aluminum is Infra Insulation, Types 6, 4, and 4 Jr.

INFRA THERMAL FACTORS. TYPE 6

Up-Heat	**C.089, R 11.23**	**= 4⅜" dry rockwool**
Wall-Heat	**C.073, R 13.69**	**= 5⅝" dry rockwool**
Down-Heat	**C.044, R 22.72**	**= 9" dry rockwool**

Infra Insulation, Inc., 525 Bway., N.Y.C. Dept. (H8)
Please send FREE "Simplified Physics of Vapor and Thermal Insulation."
Name_____
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☐ Send Prices of Infra Insulations ☐ Send Sample

INFRA INSULATION, INC.
525 Broadway, New York, N. Y.

THE EDITOR'S PAGES

Nature's boy: Guess the air conditioning, summer cooling and ventilating industry was Mother Nature's favorite in June and July. Heat waves around the nation created an unprecedented demand for equipment, and you had a hard time finding even a window fan for sale in some cities.

All-time record: For example, Carrier Corp.'s shipments during June set "an all-time record," with a 200 percent increase for room air conditioners the last week of the month as compared with the best previous week.

Sell-out: The word for the "air conditioning business" was "sell-out" the first week of July, according to Mitchell Mfg. Co., whose president said his company was "more than 30,000 room units oversold."

All gone: By the last week of June, RCA Victor had completely sold out its "initial line of room air conditioners," said Vice President Robert A. Seidel. It is hoped to double the output next year, he said.

Let's not forget: Let's try to remember — and (more important) let's make the people who need air conditioning remember — that it always gets hot and humid in the summertime. Plans to beat the heat should be made well in advance of next year's scorching days — especially for the large, complete air conditioning installations, of course.

First test: The new air conditioning at Chicago's International Amphitheatre (described in the July HPAC) got a good test the opening day of the Republican convention, when the temperature hit 96 and many Loop offices closed because of the weather. Delegates in the convention hall had their coats on, seemed quite comfortable.

On the band-wagon: The Chicago Tribune's "Inquiring Camera Girl" interviewed five delegates at the Amphitheatre a couple of days later, asked them what they thought of Chicago as a convention city. It interested us that three of them mentioned particularly — and approvingly — the air conditioned convention hall. The other two interviewees were women— and feminine fashion gives them a break in hot weather.

Incidental information: Some of the department stores are advertising women's shawls for wear in "too air conditioned places."

You can't vote: You can't vote in November if you're not registered. Be sure that you, the members of your family, and your associates don't — through plain neglect — pass up the privilege which is the foundation of our form of government.

Advice: "Value — not cost — is the real consideration in the purchase of heating equipment. This is the outstanding fact which the heating contractor must impress on the mind of his prospect." More than 5000 students who have attended the IBR School of Modern Heating have been given this advice in the final lecture by Arthur L. Wales, field training director of the Institute of Boiler and Radiator Manufacturers.

Aid to learning: The University of Louisville is seriously hampered in its teacher-training program during the summer vacation period due to lack of an air conditioned classroom, said President Philip Davidson last month in a plea for the necessary funds. Enrollment is off 800 from last year's 2600, he said, as the oppressive heat has blunted the zeal for scholarly research which is customarily shown by faculty members and graduate students.

Cold war: Melvin A. Carter waged a "cold war" last winter against his landlord, advises HPAC he's won it. He connected a record player with a thermostat in his apartment so that, when the temperature dropped below 65, a loudspeaker in the dumbwaiter shaft bellowed a reminder to the landlord (in his first floor apartment) of the pertinent provisions of the municipal code.

Looks good: Factors that may be expected to affect business operation and volume over the coming months were enumerated last month by the economic research department of the Chamber of Commerce of the United States. Generally, says the report, it looks to students of the business outlook as if the year will be good — as good at least as the first half, and perhaps better for some of the industries that have been lagging. The general strength, it is believed, will carry over into 1953. Even those who are pessimistic see no bad omens, says the report, that might ruin business in the first half of 1953.

Seven steps: A $100,000 educational program has been launched by the Minneapolis-Honeywell Regulator Co. in "a major attack upon the problem of upgrading sales among its own dealers and those of other companies as well." Heart of the program is a series of seven how-to-do-it books (published by Honeywell and now being made available to others in the industry) entitled "Seven Steps to Greater Dealer Sales."

Success secret: "No engineer can make a success without friendly, honest and helpful contractors", said Samuel R. Lewis, consulting engineer (and a member of HPAC's board of consulting and contributing editors), at the 64th annual dinner of the Heating, Piping and Air Conditioning Contractors Chicago Association, "and I am proud to be here tonight as toastmaster." Despite the hot and humid weather, the affair was lively and sociable. At the association's annual meeting preceding the dinner, Charles E. Crone, president, J. S. Kearney, vice president, C. W. Johnson, treasurer, and T. F. Kelly, secretary, were re-elected. T. M. Cunningham is the executive secretary.

Attractive prospect: Absorption of heat from exhaust mine air is an attractive prospect but needs further study to produce a workable scheme, according to E. A. Allcut and F. C. Hooper, of the University of Toronto, in a paper on possibilities of the

heat pump in Canada, published in the Journal of the Engineering Institute of Canada. Extraction of heat from mine tailings is only practicable in exceptional cases, they say, and the use of heat from mine water or underground rock is only slightly more economical than steam . . . and then only for the larger heat pumps.

Summer feature: Air conditioning has made theater-going a year 'round practice instead of one restricted to 40 weeks — the condition that prevailed in earlier days —, according to Balaban & Katz Corp., who pioneered for theater comfort as far back as 1917 when the first installation was made in its Central Park theater in Chicago.

$5.6 billion: The nation's gas distribution and pipe line industry will spend $5.6 billion for construction of new facilities and expansion of plant in the five year period extending from 1952 through 1956, the American Gas Association has estimated. This compares with construction expenditures of $5.1 billion over the past five years (a previous high record in the gas industry).

Born 1802: The du Pont Company is celebrating its 150th anniversary this year. The occasion was observed last month by employees and members of the du Pont family in ceremonies at the site of the company's first mills.

Suggestion: "Design a quiet air conditioning system for auditoriums, banquet halls and other meeting places" says a suggestion addressed to "a smart aerodynamicist" published recently in the columns of an aviation magazine and a clipping of which was sent us by Reader John H. Wiles. Air conditioning engineers know how to do so, and while there may be exceptions for one reason or another, generally do so with success. If we may join in, however, we'd be glad if the aerodynamicists would continue the same efforts insofar as planes are concerned. Our home is a few miles from a big municipal airport, but sometimes it sounds and feels as if we're right on a runway.

Gas sales down: Sales of the gas utility industry to ultimate consumers during May totaled 3578 million therms, a decline of 4.1 percent under May 1951, the American Gas Association reports. For the 12 months ended May 31, 1952, gas utility sales were 49,637 million therms, a gain of 9.6 percent over the comparable period a year earlier. The AGA's index of total gas utility sales for May 1952 was 316.2 percent of the 1935-1939 average.

Oil burner schools: The Oil-Heat Institute of America, 6 E. 39th St., New York 16, compiled recently a list of vocational and trade schools offering oil burner courses. If you need a copy, let us know.

Opposes licensing: Contractor, journeyman mechanic, apprentice and operator licensing is opposed by the manufacturers of commercial and industrial refrigerating and air conditioning equipment, as a result of discussion at the annual meeting of the Air Conditioning & Refrigerating Machinery Association. "Licensing requirements provide a ready and convenient channel for abuses such as the limiting of competition by excessive fees, through unreasonable requirements, and through administration by examining boards and enforcement agencies which may be less than impartial," says an ACRMA policy statement adopted at the meeting.

75-mile-long radiator: Engineers assigned the job of designing a heating system for Buick Motor Div.'s new Building 36 at Flint, Mich., were confronted with an unusual problem, because metal machining operations in the building involve the vaporization of cutting oils, which would result in a deposit of oil and dust on heating equipment. As a solution, a simple overhead heating system of exposed pipes was specified. The system consists of parallel runs of wrought iron pipe, totaling more than 75 miles in length, through which hot water is circulated. In effect, the parallel runs make up a giant ceiling-hung radiator.

Dog's life: Even dogs ride in comfort aboard the new American liner, the S. S. United States. The 20 individual dog kennels are completely air conditioned. The ship is the world's largest fully air conditioned superliner. According to York Corp. engineers who designed and built the 60-odd huge turbo "Freon" refrigeration compressors for cooling the queen of the American merchant fleet, there is sufficient cooling aboard to air condition more than 800 average size homes.

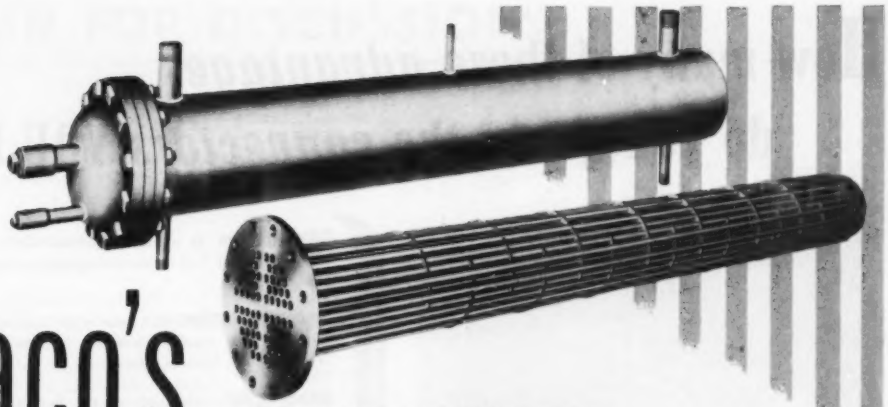
Labor shortage answer: The nation must rely more and more on industrial instrumentation and other technical developments if it is to offset the increasing imbalance between the number of workers and the number of consumers, according to R. A. Schlegel, of Minneapolis-Honeywell Regulator Co., at the semi-annual meeting of the American Society of Mechanical Engineers. The most feasible means of increasing per-worker production, he said, is by the increased application of new technological developments.

Silver anniversary: Pipe is one of man's earliest inventions, antedating even the wheel. At first it was the hollowed out limb of a tree, or was formed from clay or other handy materials. As civilization developed, piping was continually improved and its range of usefulness steadily increased. Today, as everyone knows, piping is indispensable to almost all phases of modern living. . . . . July marked the silver anniversary of a most important advance in piping history, for on July 19, 1927, Tube Turns, Inc., was incorporated and forged seamless welding fittings were made available for directional changes in piping systems.

"O. J." DIES

Oliver J. Prentice—known to friends throughout the industry and the country as "O. J."—died at the age of 85 last month, in Chicago. Memorial services were held July 17 at Oak Park.

Mr. Prentice — a life member of the American Society of Heating and Ventilating Engineers and a former president of the Illinois chapter — had been with the C. A. Dunham Co. for many years. He continued to attend the meetings and conventions of a number of societies and associations after his retirement, and was in demand as a speaker before various groups.



Taco's CWF DIRECT EXPANSION Evaporators (FOR LIQUID CHILLING OR WATER COOLING) Mean Greater Profits

FOR AIR CONDITIONING AND REFRIGERATION CONTRACTORS

Quality Construction and Better Design Give Long Life, Maintenance-Free, Low Cost Operation

TACO HEATERS, Incorporated, since 1920, has backed heating and air conditioning contractors with the highest quality heat exchangers, such as those illustrated in this ad: water heaters and coolers, fuel oil heaters, condensers, instantaneous water heaters, converters and tank heating units.

Now, Taco has increased its production facilities to match the air conditioning and refrigeration industry's growth. Taco's "know how" in large heat exchanger design and installation is at the service of all its friends in the industry.

Better Heating-Better with Taco

Taco

TACO HEATERS, INCORPORATED • 137 SOUTH STREET, PROVIDENCE 3, R. I.

TACO MAKES A WIDE LINE OF SHELL & TUBE HEAT EXCHANGERS
4 of which are shown below

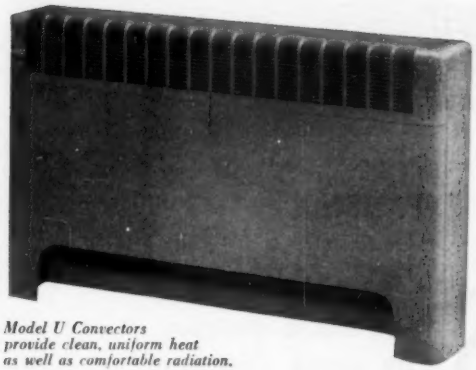
"WW" Series Water Heaters

"WS" Series Water Heaters

"TU" Series Tank Heating Units

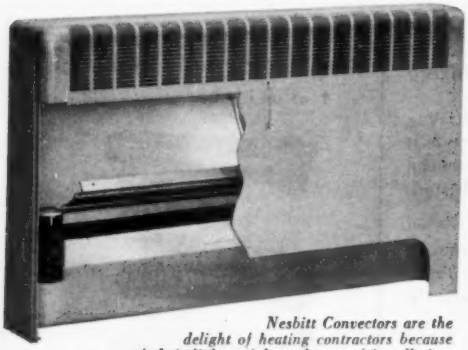
Straight Tube Heat Exchangers

How many of these *advantages* do you get in the *convectors* YOU buy?



Model U Convectors provide clean, uniform heat as well as comfortable radiation.

You get all these in **NESBITT** Model U Convectors



Nesbitt Convectors are the delight of heating contractors because of their light weight and ease of installation.

Scientific design: an *engineered* product resulting from 40 years of Nesbitt *pionairing* in the comfort heating field. ☐

Superior construction: of heavier than customary furniture steel; sturdily reinforced; built up to a reputation, not down to a price. ☐

Artistic styling: conformable to the best décor; rounded edges; functional curved-top grille for added heating capacity. ☐

Pleasing finish: phosphated metal, hardcoated in a neutral prime gray that takes a color coat well, but does not require it. ☐

Universal application: to one or two-pipe hot water systems (forced or gravity), or to two-pipe steam systems. ☐

Optional placement: the one casing may be installed free-standing or semi-recessed, as desired, with front easily removable. ☐

Easy connection: with universal headers tapped for every practicable hookup without removal of element from casing. ☐

Stock sizes: modular lengths in two heights, offering 23 standard sizes—from wholesaler stock—for practically every requirement. ☐

Honest ratings: in generous conformance with Commercial Standard 140-47 and approved by the Convector Rating Committee. ☐

Individual packing: fully assembled in a durable corrugated carton for delivery to the job in mint condition. ☐

Dampers optional: in complete separate packages, with all attachments, for easy installation, originally or later. ☐

Competitive prices: with the savings of large-volume, production-line manufacture passed on to you. ☐

Reliable guarantee: against original defects in material or workmanship, for one year from date of shipment. ☐

Order Convectors *by name:* NESBITT

Sold exclusively through Plumbing and Heating Wholesalers

A product of JOHN J. NESBITT, INC., State Road and Rhawn Street, Philadelphia 36, Penna.

"OPEN FOR DISCUSSION"

We follow here each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to participate. Address your comments to the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

REFLECTIVE CONDITIONING FURTHER EXPLAINED

As a result of several years of personal work with commercial radiant heating and cooling installations, as well as extensive laboratory experiments, I have been highly interested in Dr. Clarence A. Mills' experiments. From the earliest contact with his "Reflection Point" concept, however, I have been unable to comprehend why, in the case of structures with extensive glass areas, conventionally insulated, non-reflective walls, which would "catch and hold" the radiant energy, would not be superior to reflective interior surfaces. The latter, I believe, must tend to act like an automobile head lamp in that they will direct the high temperature source radiant energy out through the windows to waste and the low temperature source radiant energy to the cold window surfaces, which for this wave length of radiation would act as an absorbing sink.

By detailed questioning alone, can the practicing engineer properly interpret the efforts of the pioneer who ignores convention and takes things into his own hands to learn by actual experience in — not just laboratory — but actual living and working environments. From my own experiments and experiences, I concur in great detail with Dr. Mills' accounts of both the winter and summer effects on occupant comfort of the radiant conditioning of our indoor environments; the following questions — addressed to Dr. Mills — are intended only to point up the degree of error or correctness in the above analysis of the effect of the reflective surfaces.

1) In the coldest weather, was it necessary to operate your heating elements constantly in all rooms or did you still operate the elements only when the room was occupied?

2) In the coldest weather, were the doors of unoccupied rooms kept closed or were your rooms all open one to another, as in a conventional dwelling?

3) In the coldest weather, do you keep all window drapes open throughout the daylight hours or is it necessary to "button up" like a tank going into battle? If drapes are not kept closed, how do you account for the windows — being non-reflective surfaces of large relative area at around 15 F — not acting as a sink and drawing off most of your radiant energy and not drastically lowering what we might term the "effective mean radiant temperature" of your rooms?

4) The same three foregoing questions might be posed in the reverse sense in regard to the hottest summer days.

5) What sort of floor to ceiling ambient air temperature differentials did you observe in both summer and winter operation?

6) Why is cold air drifting down from windows in winter a problem? It can't be anywhere near the temperature of the outdoor air being pumped in constantly and, off hand, one would not expect it to amount to such large volumes either.

7) In your conventional heat loss and gain calculations, was consideration given to the insulation effect (apparently always present when design loads are encountered) of the window drapes? — Albert T. Jorn, Chief Development Engineer, Architectural Products Div., Burgess-Manning Co.

Reply by Dr. Mills — In answer to Mr. Jorn's queries, I would offer the following remarks:

1) Since our maximum possible heat input was only 97,000 Btu per hr in a structure rated to need 152,000 Btu at 0 F, it was found necessary to operate all heating elements constantly when outdoor temperatures were at 0 F or below. At slightly higher outdoor temperatures (10 F, for instance) unoccupied rooms could be left unheated, although a considerable lag was experienced in bringing them up to the comfort point when desired for use. Only with lighter heating loads, when outside temperatures were well above freezing, can free use be made of individual room cut-offs in the average house, except perhaps for space seldom to be used.

2) All doors (except for closets) were left open at all times, whether or not the rooms were occupied.

3) In coldest weather, the heat reflective window drapes are kept almost completely closed to avoid the "sink" effect of the cold glass. While outdoor clear visibility is thus lost, adequate illumination comes through the drapery material to allow reading or other usual activities without artificial aid. This means also that much of the glassed area's psychic effect on occupants is retained even when the drapes are completely drawn. During sunshiny periods of even the coldest weather, the window draperies are drawn wide open to admit inflow of the short wave length solar heat which passes readily through the large glassed areas. This is done only with those windows exposed to direct sunlight, for winter's secondary sky radiation is ineffective.

4) These same considerations do indeed apply (in the reverse sense) to cooling operations during the hottest summer days (outside temperatures at 95 F or above). These details were rather fully discussed in the original operational report. [see February 1952 HPAC.]

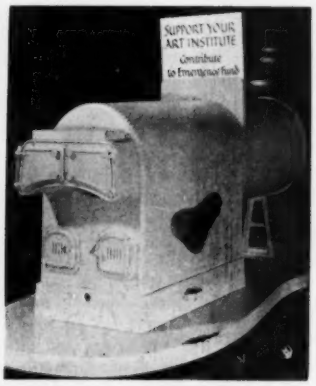
5) Air temperatures (in both winter heating and summer cooling) showed roughly ½ F rise per ft from the floor to the lower edge of the 12 in. ceiling beams. The upper 6 in. air layer next to the ceiling between the beams showed marked convection heating from the exposed electrical heating rods located around each room's perimeter 5 in. down from the ceiling. In severe cold with full heat on, such ceiling temperatures rise as high as 125 F and calculations would incidate then a probable direct ceiling loss of around 30 percent of our total heat input. Preliminary tests with the heat transparent plastic sheeting over our new style

troughs indicate a very marked reduction in such direct convection air heating without noticeable effect on radiant heat delivery to the floor area. Marked operational efficiency thus should result from use of this heat transparent plastic sheeting over the troughs. Apparently, the low grade convection heating of air in direct contact with the broad exposure of carpet and furniture fabric surfaces (themselves radiantly heated from the hot trough surfaces) largely accounts for the low vertical gradient in air temperatures.

6) Downward cascading cold air from glassed areas is of much smaller volume than that being pumped in through the air filter from outdoors, but it tends to mix with general room air less freely than is the case with that purposely introduced through the perforated central hall ceiling. Even the latter we now know must be preheated in subfreezing weather before its introduction into the living areas. Since the new hot and chilled water circulating system now being installed in the troughs will also have a heating-cooling coil in the air intake for winter preheating and summer dehumidifying of the incoming 370 cfm of outside air, the new system should operate very well — with little relative load increase.

7) The thin satin window draperies were not entered into the conventional heat gain and heat loss calculations for the structure. Such information on satin is not carried in the usual heat loss tables. So far as we are concerned, this drapery material functions mainly by virtue of the high heat reflectivity and low heat emissivity of its aluminized surface facing the room.

8) I should like to offer three suggestions relative to Mr. Jorn's remarks in his first paragraph, on heat emitting warm walls of insulated conventional materials versus our heat reflective foil wall papers. First, I would point out that the embossed foil wall papers provide the same diffuse scattering of reflected heat rays that take place with radiant heat emission from warmed walls of conventional materials. Second, if such warmed walls are to be a positive factor in room heating, their surface temperatures must be above those of the air — with resulting convection air currents which will remove wall-contained heat much more rapidly than it can be radiated. Third, if the warmed wall is to serve only the negative function of eliminating the "sink" effect of a cold wall, why does not the foil wall paper still provide the better answer — in eliminating the cold wall "sink" effect without the expenditure of heat to warm the wall materials? — CLARENCE A. MILLS, M.D., Professor of Experimental Medicine, University of Cincinnati.



MODEL OF BOILER — loaned by Kewanee — served as receptacle for contributions to Art Institute of Chicago's campaign for funds for new heating facilities. Model was on display in the building's lobby.

SHOULD ALL DRAFT CONTROLS BE CALIBRATED?

PROPOSALS ARE MADE now and then that all draft controls have markings or calibrations so that they may be adjusted without the aid of draft gages. The idea is not new, as quantities of controls have been made in the last 10 or 12 years which were so calibrated.

The big question is whether it is wise to mark or calibrate *all* controls to indicate the drafts being maintained. Most draft controls must be designed so that they can be used on the heating units made by almost any manufacturer and on a great variety of furnaces and boilers. It must be possible to take a draft control "off the shelf" and install it with confidence that it will work properly.

The more important objection to calibrating all controls is that no two furnaces or boilers are identical in construction. The correct setting for the draft regulator must be the one that provides the proper draft *over the fire*, regardless of that which is observed in the flue pipe. If the firing rate of the burner is changed materially a change in the draft control may be necessary, too. Usually, CO_2 and flue temperature readings are taken when adjusting an oil burner, and the overfire draft set at the minimum which will just carry away the flue products. Drafts in excess of this will waste fuel.

If the installer should be instructed to set each draft control at some particular calibration mark, of necessity each control *must* be installed in the same relation to the smoke outlet of the furnace (as, for instance, always as part of a horizontal flue, at a fixed distance from the furnace, with no elbows between.) Or perhaps it always must form a part of a vertical run of pipe, being located the *same* distance above the floor. Unless this uniformity of installation is mandatory, the overfire draft with one furnace will differ considerably from that of another of the same construction, even though both draft controls have the same settings. The variations in drafts maintained will not be insignificant either.

Draft readings taken at different points in a flue or smoke pipe vary considerably also, especially in the proximity of elbows. At its best, a calibrated draft regulator can maintain the draft indicated by the position of the weight only at a point in the flue closely adjacent to the regulator. And unless the weight of a control is adjusted to a different position for a vertical pipe installation, as compared to a horizontal pipe installation, a draft reading taken in a vertical flue pipe below the draft control will be greater than that found in a horizontal pipe, at the same distance from the regulator.

It would not be very hard to add calibrations to most controls, but — if it were done — installers might expect the overfire draft readings, or the readings at numerous places in the flue pipes, to agree exactly with the markings on the regulators.

To sum up the matter, all controls could be calibrated, but the results might not be good. It is safer to adjust the control by using combustion testing apparatus, checking for CO_2, flue temperature, smoke and draft.—E. A. FIELD, Research Director, Field Control Div.

ANOTHER CASE OF *Copper* WHERE IT COUNTS

Designers, architects, contractors and builders tell us that in many cases there simply is no adequate substitute for copper. As a result they are using what copper they can get where it counts most. One of those places is in hot and cold water lines in homes like the one shown. This installation required 90' of ¾" and 160' of ½" Revere Copper Water Tube, Type L. This National Award Winning Home was built by Jere Strizek. Designer was John W. Davis, both of Sacramento, Cal. There are more than 100 similar homes in the Town & Country area where this house was built. Plumbing contractor for 31 of the homes (all of which contain Revere Copper Water Tube) was Beckes & Anderson, Carmichael, Cal.

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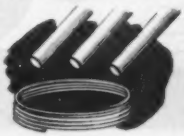

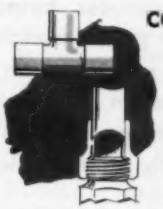

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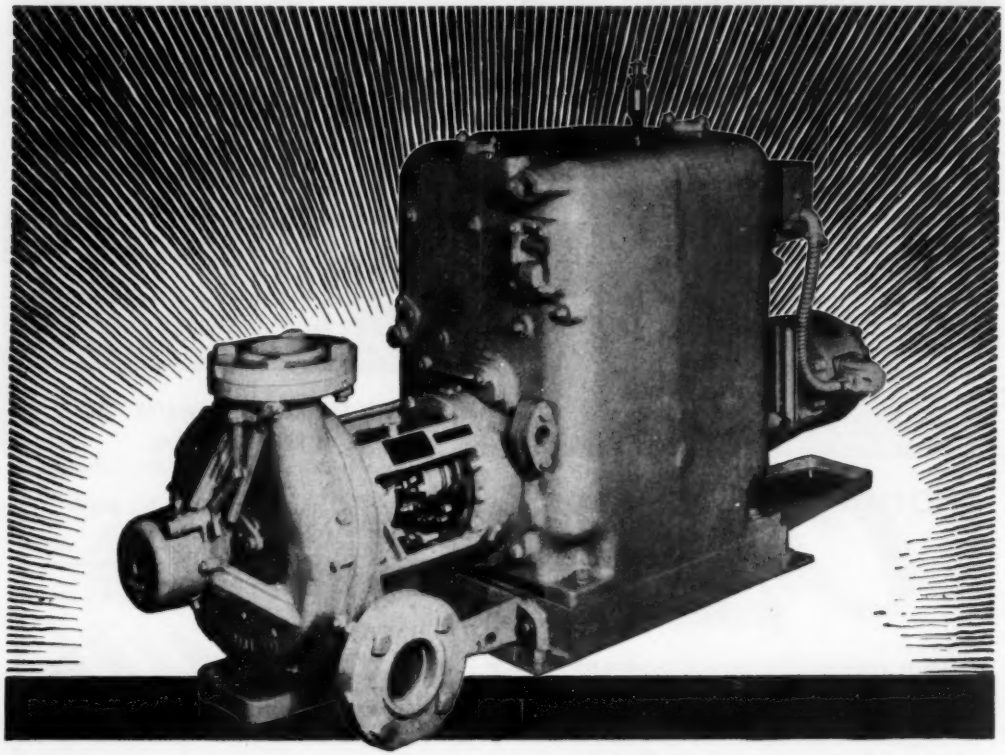

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This pump insures constant heat in the system, it eliminates electric current cost, and it promotes high efficiency in the heating system. Heating efficiency is due to the fact that this pump can operate continuously with economy. Continuous operation means uniform circulation, and uniform conditions in the system mean steam saving.

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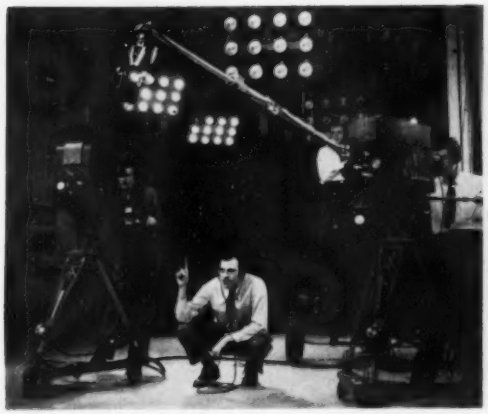


TELEVISION BROADCASTING is only possible with the use of air conditioning, as enormous amounts of heat are generated. The TV studio itself presents a year 'round cooling problem

HEAVY SMOKING in TV control rooms often presents a problem, and copious ventilation is required. The ideal system would be air conditioning for the occupants, ventilation for equipment

How To Air Condition Television Stations

Lifting of FCC Freeze on New TV Stations Indicates Big Application of Air Conditioning; TV Depends on AC Because of Large Heat Loads

By J. F. Schmidt
Carrier Corp.

THE LIFTING OF THE three year freeze on new television stations recently announced by the Federal Communications Commission will soon bring a flood of new station construction. Air conditioning and ventilation are essentials in every TV station.

An idea of how wide this application of air conditioning will be can be had by comparing the current number of 170 stations in 63 cities with the 2053 stations allocated to 1291 communities by the FCC.

Enormous Amounts of Heat Generated

Every step in the production and transmission of a television program is accompanied by the generation of enormous amounts of heat. In many cases this heat is liberated in very confined spaces. Thus, television broadcasting is only possible with the use of air conditioning.

The author has conducted a study of the special problems connected with air conditioning a television studio and the results are summarized here.

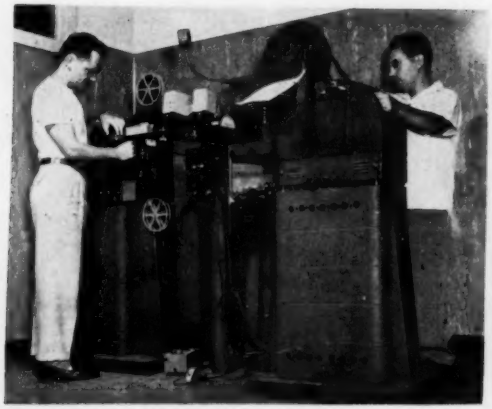
The television industry is dynamic and growing; thus, techniques and equipment change at a rapid rate.

The design of an air conditioning system for a television station is similar in many respects to that employed in motion picture sound stages and broadcasting studios. There are, however, basic differences which affect the design.

In addition to the *television studio* which is used for live shows, there are other spaces in a TV station which require air conditioning. These spaces are:

1) Projection room.
2) Control rooms.
3) Transmitter room.
4) Commentator booth.
5) Test and repair rooms.
6) Miscellaneous rooms.

Each of these spaces will be discussed separately. In many cases, zoning of the different spaces will be required.



HEAT LOADS IN PROJECTION ROOMS vary widely, depending on whether it is a small station or a network broadcaster. Lighting load is small and people load is one or two

THE SWEATER this technician in a transmitter room is wearing perhaps explains some of the weird patterns you get on your TV screen at home. Transmitter room usually has constant heat load

The television studio is the space in which the live shows are produced. This production requires actors, scenery, stage properties, lights, television cameras, boom microphones and other special equipment (such as motion picture projectors for background effects.)

Air Conditioning the Television Studio

Studio floor areas vary in size from 15 x 30 ft to 75 x 100 ft, with 30 x 60 and a 16 ft ceiling height as an average. Television studios usually are larger than motion picture sound stages or radio broadcasting studios, because television must produce a continuous flow of material and thus does not have preparation time available. For this reason, many sets are located in the same room, sometimes two and three deep. In some cases, this necessitates removing or relocating sets during a telecast.

The sound level in a television studio is higher than that considered essential for a radio broadcast studio due to the sounds from moving scenery, cameras and personnel. Directional microphones have been developed to overcome this problem, but the room must still be acoustically treated for a low overall sound level.

The studio is usually a room built without outside walls and constructed with massive, tight partitions. Sometimes the precaution is taken of constructing floating walls and even floating floors and ceilings. The space surrounding this studio room is kept at a relatively low sound level. Additional sound treatment usually consists of lining the entire wall and ceiling area with insulation. Entrances and exits are often built with sound locks. This type of construction results in a practically airtight room having a low heat transmission factor.

The main sources of room heat gain are lights and camera load, with transmission (including solar) and people also contributing. Usually four people are present plus the program participants (actors, announcers, etc.) — which may run high in certain programs, such as with a choir or glee club. However, the duration of such heavy people peaks is usually short. This point should be checked with the station administration. When the duration of heavy people loads is less than 1 hr in length and a slight increase in temperature is permissible, it can usually be neglected.

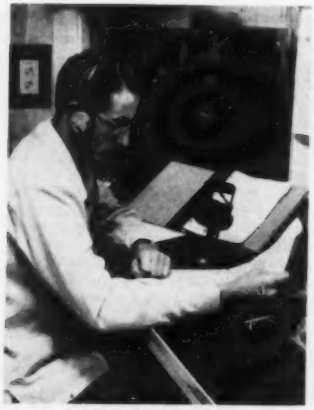
Studio Lighting—Modern image orthicon television cameras now in use require between 100 to 200 footcandles of incandescent light for proper operation. To obtain this lighting intensity requires approximately 40 watts per sq ft with a diversification factor of 50 percent. Although all or most of the lights may be on for a short time, the average will be approximately 50 percent. This diversification factor will change with studio size and probably will be lower for large studios. The maximum lighting load and diversity factor should be checked on each job.

Even with fluorescent lights, which are more efficient than incandescent, the above wattage figure will not change. Fluorescent lights are usually used only for base or key lighting and incandescent lighting is used for modelling or dramatic effects by means of spots. Also, any increase in lighting efficiency is generally used to reduce the camera lens aperture opening (or stop) and thus obtain a greater depth of field. This produces sharper images on the screen.

Design Conditions—The studio design conditions are a compromise between ideal conditions and economics. Relatively low temperatures should be maintained the year 'round to compensate for the high radiant effect of the intense lighting and to reduce perspiration. The specific humidity of the air must be kept low in order that the increased body heat loss due to evaporation will offset the radiant heat gain from lights. Taking into account all these considerations, design conditions of 75 F dry bulb and 50 percent relative humidity are indicated in summer. The partial load control of the studio should be designed to give low humidities at all times.

When in use, the studio presents a cooling problem all year 'round and should be designed for that consideration. However, in winter the design dry bulb condition can be lowered to 72 F.

Air Distribution—In order to reduce the air conditioning load, the



THE COMMENTATOR (or announcer's) booth is a small room for one man. Load is zero when room is not being used

supply air is usually introduced below the lights, which are hung from the ceiling on a pipe grid. This encourages the stratification of some of the lighting heat load at the ceiling, which can be removed by ceiling exhaust.

As mentioned previously, the studio is a very tight room—thus, some means of exhaust is required in order that ventilation air can be supplied to the space.

Ceiling outlets on a vertical drop from an overhead supply duct have been used in some studios, but will usually prove to be in the way of lights and other equipment. The ducts would also have to be insulated to reduce to a minimum the gain from the stratified heat from the lights. Side wall distribution is frequently preferred to overcome these objections.

Good air distribution is required in the entire space to prevent drafts. The blowing of clothing or set properties cannot be tolerated.

Sound Treatment—The sound level in the studio is critical—but not so critical as in a sound stage. Specific requirements should be obtained from the customer.

Sound attenuation is always required to produce the low sound level required. The amount of attenuation will have to be calculated from the requirements of the studio, equipment sound level, and air distribution system design. The following paragraphs give some pointers and ideas that should prove helpful in obtaining sufficient sound attenuation.

When long runs of ductwork are required, lining the ducts with sound absorbent material (1 or 2 in. thick) may give the required attenuation. This material will also double as thermal insulation and reduce heat gain to the supply air. Where the duct length is limited, plate type sound absorber cells are required. These methods are more efficient on high frequency sound; thus, extra precautions must be taken to prevent low frequency sound transmission. Elbows give good sound attenuation at lower frequencies. Thus, good practice indicates the use of at least two elbows between the first outlet and the equipment.

Canvas duct connections at the unit and before each outlet are required. The ductwork should be supported by vibration isolating hangers. Where ducts go through walls or floors, they should be completely isolated or free from contact to prevent vibration transmission.

All reciprocating or rotating machinery—such as fans, compressors, evaporative condensers, etc.—should be isolated to prevent vibrations through the structure or building. When this equipment is located on upper floors, elaborate isolation methods are required. This location should therefore be avoided when possible.

Supply and return outlets should be selected for low noise level operation. Supply air duct velocity in the runouts to the outlets should not exceed 500 to 600 fpm. Return air duct velocities at the outlets should not exceed 250 to 350 fpm.

Smoking a Problem in Control Rooms

The control room houses the heat producing television equipment, such as the camera control units, picture monitors and audio equipment, and from five to eight persons. The rooms are usually small (15 x 10 x 8 ft high) with a large heat load (4 to 10 kw.) The people usually consist of a video engineer, an audio engineer, a producer, an assistant producer, a technical director and others —such as sponsors or observers. Heavy smoking usually presents a problem and copious ventilation is required.

The ideal system for cooling such a room would be a split system—air conditioning for the occupants, and ventilation or cooling with outside air for the equipment. However, present TV equipment is such that this would not be a simple procedure and until equipment for better heat venting is designed and manufactured, the air conditioning engineer will have to use ingenuity on each job. The radiant effect of the equipment is considerable and shields should be used when practical. The supply air should be introduced in the vicinity of the occupants who are usually raised above the equipment. The air should then be pulled over the equipment into the return. In some control rooms one or two men sit on the lower level in front of the equipment. Provision for cooling them should be included.

Sound treatment of this room is equal in importance to the studio, because here the sound quality of the show being telecast is judged by means of the audio monitor.

The load in the control room fluctuates between a maximum when a live show is being produced and a very low minimum when only a network show is being taken off the cable and re-transmitted. The controls and system must be designed with this fluctuation in mind.

Cleanliness here and in other spaces is important to reduce maintenance of the TV equipment. Some stations have used electrostatic filters to reduce dust and dirt to a minimum.

Projection Room Heat Loads Vary

In the projection room is located the projection equipment for movies, advertisements, test patterns, etc. Often, the pick-up cameras and monitors are also in this room. Heat loads from equipment will vary between 2.5 and 12 kw depending on whether it is a small station or a network broadcaster. Lighting load is small and people load is one or two projectionists. When 35 mm motion picture film is used, the ventilation is determined by governing codes.

Cleanliness is also very important in this room to keep the film in top condition and air filtering should be highly efficient.

Transmitter Room Usually Has Constant Heat Load

The transmitter room (or master control room) is where the program is actually transmitted from the sta-

tion. The transmitter itself produces a large quantity of heat, but is cooled by both air and distilled water by means of systems which are usually furnished as an integral part of the transmitter.

In spite of this cooling, 1 to 2 kw of heat is dissipated into the room. The largest heat load in the room is represented by the racks of auxiliary equipment. Each auxiliary equipment rack may have a heat load of 2 kw. A normal transmitter room may have 10 to 12 kw load in racks. These racks are arranged so that they can be placed in a separate room which is ventilated for equipment cooling, or ventilation air can be passed through each rack to remove the heat and thus keep that load separate from the air conditioning load. Cleanliness of the air again is important.

The transmitter room usually has a constant heat load whenever the station is on the air, whereas the studio and control room fluctuate depending on whether a live show or a network show off the wire is being telecast. For that reason, it is usually more satisfactory to put this room on a separate system—such as a self contained unit. Thus, constant cooling of this space can be accomplished without problems of partial load control in the other spaces.

The ventilation air used to cool the transmitter and auxiliary equipment should be discharged outdoors in the summer, but can be utilized for partial heating of the station in winter.

Avoid Over-Cooling the Commentators

The commentator (or announcer's) booth is a small soundproof room built for one man with an audio and video monitor used for spot announcements, advertisements and station calls. Because the load is zero when the room is not being used and the frequency of use is small, a control system to prevent overcooling is required.

On-off control of air is probably satisfactory if dampers are tight and designed for low sound level and located before a sound absorber of at least 15 db value. Reheat control is probably the best method when steam or hot water is available all year 'round. Room air conditioners have also been used, but sometimes present difficult sound problems.

Miscellaneous Spaces Are "Normal" Applications

Miscellaneous spaces—such as test and repair rooms, offices, dressing rooms, storage rooms, rehearsal rooms, etc.—are in the classification of normal comfort air conditioning applications and can be handled in the normal manner.

Industrial Health Meeting Draws 2000 Attendance

THE MEETING which brings together annually five groups active in industrial health matters was held this year in Cincinnati. The regular groups joining in the conference were the American Industrial Hygiene Association, the American Conference of Governmental Industrial Hygienists, the Industrial Medical Association, the American Association of Industrial Nurses and the American Association of Industrial Dentists. Several other groups — including the U.S. Navy industrial health organization and the U. S. Atomic Energy Commission — held meetings during the convention. The number in attendance exceeded 2000.

Whereas the aim of the different groups that join in this annual meeting is the same — improvement of the health of the industrial worker — the American Industrial Hygiene Association approaches the objective from the engineering viewpoint, with the result that many papers given at its sessions are of particular interest to the readers of HPAC. This is especially true of those engaged in industrial ventilation of all kinds.

The first AIHA session was devoted to a discussion of the Detroit-Windsor air pollution study currently in progress and sponsored jointly by the U. S. and Canada. This session was followed by several on the toxicological and chemical aspects of occupational diseases and their control.

One day of the week-long gathering was devoted to concurrent separate meetings on air pollution, chemical and analytical procedures, engineering, radiation, and toxicology. The papers given at the engineering sessions were:

Design Factors for Vacuum Cleaning and High Pressure Pneumatic Conveying Systems, by Knowlton J. Caplan, H. J. Hersey Co., and R. L. Stephenson, United States Hoffman Machinery Corp.

The Industrial Hygiene and Ventilation Factors in a Large Air Conditioned Shop, by J. W. Hammond and R. J. Davis, Humble Oil and Refining Co.

General Ventilation as a Control of Air Contaminants — A Model Study, by K. E. Robinson, Michigan Department of Health.

Design Velocity in Industrial Exhaust Systems, by Arthur C. Stern, New York State Department of Labor.

An Evaluation of Commercial Wet Dust Collectors and Electrostatic Precipitators, by R. Dennis, M. W. First, and L. Silverman, Harvard University School of Public Health.

Effectiveness of the Fog Filter for Removing Dusts, Fumes and Mists from Air, by Frank A. Thomas, Georgia Institute of Technology.

Performance Characteristics of Laboratory Hoods, by M. G. Kershaw, P. A. Coerver and O. C. Utley, E. I. duPont de Nemours & Co.

Concentrations of Particulates Found in Air, by Melvin W. First and Philip Drinker, Harvard University School of Public Health.

Field Equipment for the Collection of Toxic and Radioactive Contaminants, by W. B. Harris, H. D. LeVine and M. Eisenbud, Atomic Energy Commission.

Engineering Control of a Multiple Source Hazard of Carbon Monoxide, by George S. Reichenbach and A. D. Brandt, Bethlehem Steel Co.

The Control of Cupola Emissions by Electrostatic Precipitators, by W. F. Dehley and J. C. Radcliffe, Ford Motor Co.

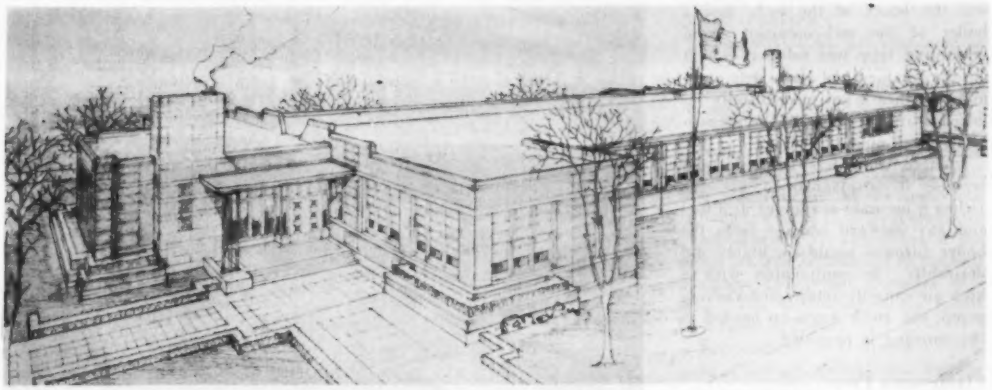
Holding concurrent meetings on several of the different aspects of industrial hygiene was a new venture which proved very successful and is to be repeated at the 1953 convention. All of the meeting rooms were crowded and even standing room was not available in some.

The 1953 meeting of these same groups is scheduled to be held in the new Statler hotel, Los Angeles, during the week of April 19. — ALLEN D. BRANDT.

WORK OUT NEW THREADS FOR SCREWS

PROGRESS IN development of the world's first international standard threads for screws was reported by the International Organization for Standardization, meeting in a recent two-week triennial session.

Delegates from 15 nations met to work out new standard threads for screws in very small sizes.



NEW DESIGN FOR SCHOOLS for Chicago's residential neighborhoods is exemplified in Hale Branch school, of one floor construction. Building is intended to be a center of community social life

Heating and Ventilating Chicago's Hale Branch School

How the prototype of a new design for one floor schools for suburban residential neighborhoods is heated and ventilated. Unit ventilators installed in classrooms; packaged boiler with induced draft supplies steam

By Joseph L. Fatz, Jr.
Mechanical Engineer,
Chicago Board of Education

THE CHICAGO BOARD of Education has embarked on a supplementary building program — in addition to its regular annual program — to catch up with the four-year lag caused by World War II and increased grade school enrollments.

For the suburban residential neighborhoods, where ground is relatively plentiful and the population density is comparatively low, a modern rural type of school building has been developed. It has bigger classrooms, all located on one floor, large window areas, and finished concrete block walls instead of plaster. The building is intended to be suitable for use as a part of the community social life.

The board maintains its own architectural department, headed by John C. Christensen, complete with structural, electrical and mechanical divisions and the other necessary supplements to a complete architectural service.

With the previously listed qualifications in mind, the mechanical division of the architectural department began work on a suitable heating and ventilating system for the Hale Branch school, first of the buildings of this new type.

Since only part of the building is to be used as a community social center, it was decided to heat and ventilate the classrooms and kindergartens individually with unit ventilators.

Packaged Boiler Supplies Heating Steam

A school the size of this one will have a janitor as the custodian — rather than a trained operating engineer — because of economics, and this affects the choice of the heating method. Careful consideration was given to the problem of steam trap maintenance as compared to that of possible freeze-ups and the ways of guarding against freeze-ups. It was decided that steam trap maintenance

was the lesser of the evils, and a boiler of the self-contained steam generating type was selected, which is self-contained and completely automatic. Since it has mechanically induced draft, it eliminates the necessity for a chimney.

Induced draft was insisted upon because it is planned to use gas (when it becomes available) as a fuel and any outward leakage from the boiler furnace would be highly undesirable. In conjunction with a high air capacity return line vacuum pump, the quick warm-up needed in the morning is provided.

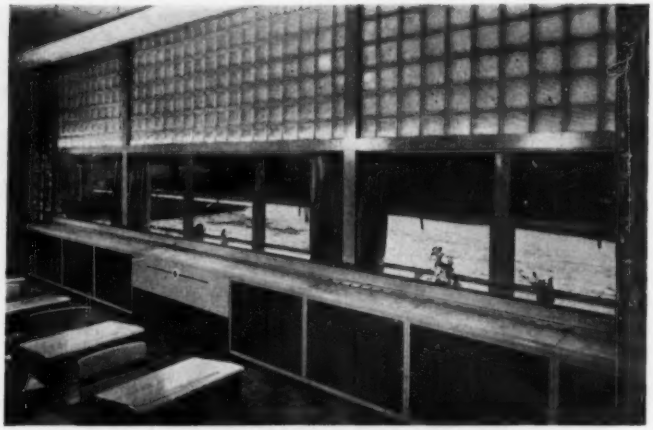
Classrooms Pose Heating Problem

Before the final heating and ventilating system was selected for maintaining the classrooms at the design conditions of 70 F dry bulb and 40 percent relative humidity, considerable thought and study was given to the performance characteristics of the mechanical equipment to be installed. The operating conditions the equipment must contend with are intermittent occupancy, large window area, rapid response because of the comparatively thermally light structure and the sudden change in outside conditions common to Chicago, and the increased health standards.

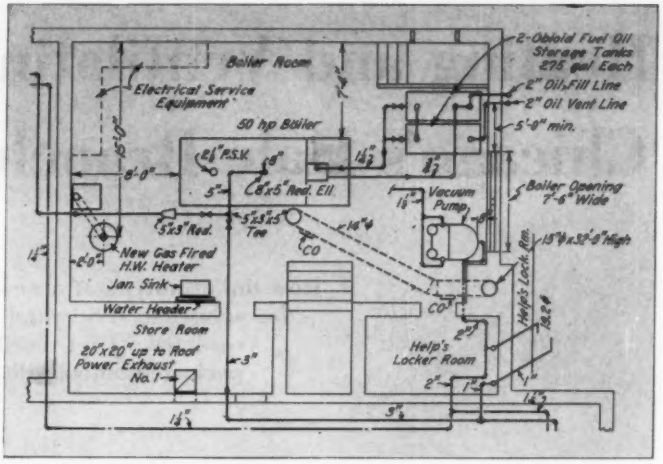
Because of their part-time occupancy, classrooms are heated on an intermittent basis. The rate of occupancy is not constant because pupils are in and out of the room during recesses and at other periods.

In practice, the typical classroom may require up to 50 percent as much heat for warming the minimum quantity of air for ventilation as is needed to overcome the heat loss through walls and windows. Since ventilation of the room need not begin until after it is occupied, this excess capacity can be utilized to raise the room temperature by supplying heat at an accelerated rate — which may be two or three times the rate at which it is escaping from the room, even in the coldest weather.

Once the room is occupied, its steady heat loss is increased approximately 50 percent by the ventilating load. Thus, a typical one-exposure classroom may have a heat loss through the wall and windows of about 61,000 Btu per hr at −10 F. The ventilation load, figured at a minimum rate of 10 cfm per pupil, will be about 34,000 Btu. On the other hand, the heat given off by the pupils may be as much as 9600 Btu per hr. Relative to the total heat loss of 95,000 Btu at −10 F, this 9600 Btu gain is not very significant, but in winter weather of 40 to 50 F, when the heat loss goes down to some 35,000 to 24,000 Btu, it is very important. With no other source of heat gain, the gain from the school room occupants, under the conditions outlined, will completely balance the heat loss at about 62 F outdoor temperature, figuring the usual 15 mph wind. The modern lighting system also adds to the heat gain.



UNIT VENTILATORS ARE USED to meet the heating problems peculiar to classrooms. This photo shows a similar installation to that at the Hale Branch school



BOILER ROOM at the new school is quite compact. A self-contained package boiler furnishes steam for heating, requires little operating attention

Thus, the school classroom presents the paradoxical requirement of a positive need for winter cooling. The method used to obtain cooling is the introduction of outdoor air — over and above that needed for the control of odors — to avoid overheating of the room due to internal heat gain.

It is well understood that it is economically impossible to heat glass and, therefore, the increased glass or window area in the modern classroom provides an important source of objectionable drafts caused by the rapid cooling of the room air near the windows by the cold glass —

even when the outdoor temperature is as high as 30 to 40 deg.

Unit Ventilators Were Selected

After a rather thorough study of the conditions to be met and the available equipment for solving the problem of proper heating and ventilation of the classroom and the elimination of window downdrafts, the classroom system consists of a unit ventilator located at the center of the outside wall, flanked by utility cabinets running approximately the full length of the room. A continuous longitudinal window sill recirculation grille is provided as an integral part of the cabinet, and room air is recirculated through this grille. The downdraft from the windows is picked up with the recirculated air and carried back to the unit ventilator — thus preventing it from entering the room as an objectionable draft.

The operation of this system is briefly as follows: When the room temperature is below that of the thermostat setting, the unit ventilator discharges 100 percent recirculated air, pulling all the recirculated air through the recirculation grilles (including the cold downdraft from the windows.) When the room temperature reaches the approximate setting of the thermostat, the outdoor damper opens to its minimum position, which is 33-1/3 percent outside air, and this percentage of outside air is mixed with 66-2/3 percent recirculated room air. As the temperature continues to rise, the heating capacity of the unit ventilator is throttled and additional quantities of outdoor air are taken into the room to result in a lower outlet temperature.

With this type of supplementary equipment for eliminating the window downdraft, the equipment is in operation almost 100 percent of the time without danger of overheating the room.

Uniform velocity through the grilles is assured by the adjustment of dampers located immediately under the grilles. Several similar installations were observed in successful operation in extremely cold weather and mild winter weather before it was decided to use the scheme. The system is simple and foolproof and no additional mechanical equipment in the way of traps or valves other than those in the unit ventilator proper are required.

In order to improve further the sanitary air conditions and reduce the incidence of childhood diseases in the kindergartens, the unit ventilators were equipped with a new type of germicidal lamp. All air handled by the unit ventilator passes over the germicidal lamps, which are out of sight.

Waste Heat Solves Cold Floor Problem

To solve the problem of cold floors, it was decided to make use of two heat losses that normally go to waste.

The first is the heat loss from the steam piping. In the Hale Branch school, the steam piping was purposely left bare to partially warm the floor slabs.

The second is that of the exhausted classroom air required by the city code, which is one-third of the supply. Normally, this warm air is forced directly outside, but in the Hale Branch school the air is first drawn into the 54 in. high crawl space from which it is exhausted through a vertical duct by a roof power ventilator.

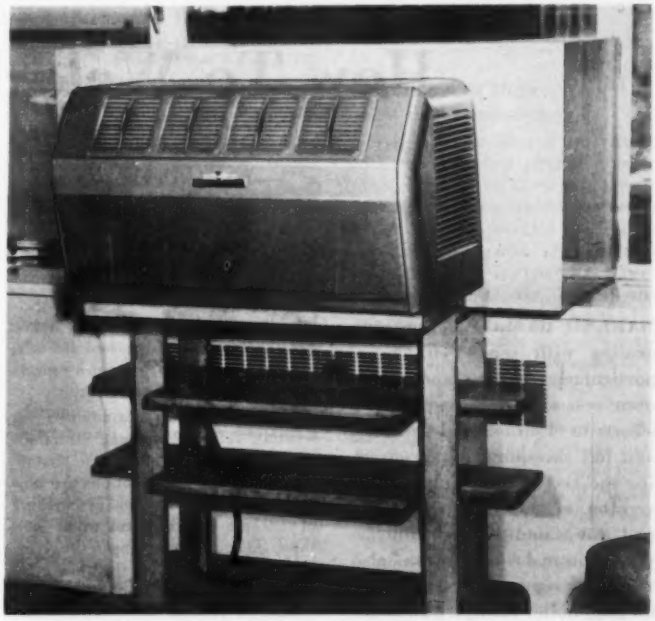
The toilet rooms are ventilated by means of a conventional trunk duct system and a second roof power exhauster.

Control of the humidity, as required by the city code, is accomplished quite easily. The introduction of outside air by the unit ventilator is sufficient to prevent excessive humidification. A humidifier of the steam jet type is installed in the unit ventilator to prevent excessive dryness. The humidifier is controlled by a room hygrostat.

Temperature and humidity controls of the all electric, low voltage type are installed in each classroom and the kindergarten.

The performance of this heating and ventilating system will be watched closely for the first few months of operation to see if any variations in design should be incorporated in the schools following this prototype.

[P. Nacey Co., Inc., is the mechanical contractor for this installation.]



NEW METHOD FOR installing a room air conditioner even when building rules forbid equipment projecting beyond building line is shown here. This unit in a new apartment overcame two problems — a metal frame casement window and a radiator beneath the window which would have been blocked by a console unit. (Photo courtesy Mitchell Mfg. Co.)

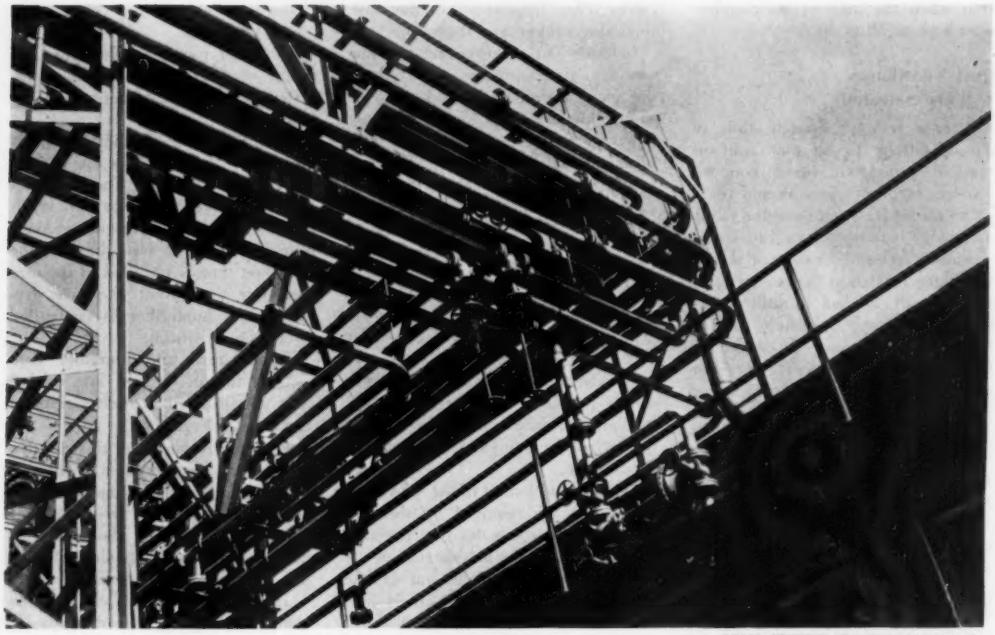


PHOTO COURTESY TENNESSEE EASTMAN CO.

How To Weld Pipe

—particularly stainless and aluminum—separation of mechanical bids, and reports on heating and air conditioning feature HPACCNA's meeting

MARKED BY LIVELY sessions dealing with pipe welding — particularly stainless and aluminum — and the association's efforts to eliminate bid peddling and bid shopping, the program for the recent 63rd annual convention of the Heating, Piping and Air Conditioning Contractors National Association also included reports on air conditioning, boiler ratings, baseboard heating and solar heating

PIPE WELDING was featured at the Heating, Piping and Air Conditioning Contractors National Association 63rd annual convention — held this year in Boston — in a scheduled talk, a panel discussion, committee reports and discussion from the floor.

The HPACCNA's committee on welding reported through its chairman, Richard S. Tobin, of Boston, that procedure specifications are now available for the metallic arc welding of chrome molybdenum alloy steel pipe, fittings and flanges, together with procedure specifications for metallic arc welding of 2¼ percent chrome, 1 percent molybdenum alloy steel pipe, fittings and flanges. Inasmuch as these specifications are identical with those qualified by the National Certified Pipe Welding Bureau, the committee recommended that they be adopted for use by members of the association.

Stainless and Aluminum Welding Procedures

The pipe welding bureau has been engaged during the last year in developing aluminum and stainless steel welding methods. As a result, a procedure specification has been formulated and qualified for inert gas shielded arc welding of thin wall stainless steel pipe, and procedure specifications have been prepared and are now in the process of being qualified for arc welding of heavy wall stainless steel pipe, and for inert gas shielded arc welding of aluminum pipe.

In his talk on welding aluminum and stainless pipe, Professor Robert S. Green — of Ohio State University and technical consultant to the bureau — briefly described these procedures and mentioned some of the problems encountered in their development. In regard to stainless, the term "thin wall" was defined as covering wall thicknesses of $\frac{1}{16}$ to $\frac{1}{4}$ in., and "heavy wall" as covering $\frac{1}{8}$ to 2 in. thicknesses (there being a slight overlap in the sizes.) In general, for the welding of stainless (types 304, 316 and 347) no preheat or post-heat treatments are recommended. However, it is recognized that specifications and codes may require heat treatment, and in such instances it is recommended that there be no post-heat treatment between temperatures of 1000 and 1600 F.

In developing the aluminum pipe welding procedures, it was felt necessary to set forth a method which could be used either with or without backing rings. The specifications, therefore, cover the use of a-c current and an argon shield and also the use of d-c current and a helium shield.

At the conclusion of this talk, John H. Zink, of Baltimore, representative on the ASME pressure piping code committee, said that manufacturers are opposed to heat treatment of stainless valves up through $\frac{1}{2}$ in. wall thickness, and he asked Professor Green's opinion on this — and also whether the new procedures included cutting methods. Professor Green replied that the question on heat treatment could not be answered accurately unless the service was specified. However, he stressed that much stainless welding can be done without post-heat treatment.

What's Best Time To Post-Heat?

During a later panel discussion, the subject of stress relieving in connection with pipe welding was brought up, and a member asked whether it is better to do the stress relieving directly after completion of the weld or whether it is satisfactory to post-heat at some other more convenient time. Mr. Tobin expressed the opinion that the use of resistance preheating would probably indicate that performance of all of the welding, with subsequent post-heating, is simpler. Professor Green mentioned that post-heating is not only stress relieving but also tempering, and he believes that it is better to post-heat as soon as possible, "particularly if there is any hardenability in the steel" (as in chrome steels).

In response to several questions, Messrs. Green, Tobin and E. P. Everhard (of Chicago, chairman of the association's research committee) explained that there is a very noticeable increase in the extent to which piping specifications are now being written to include ASME code requirements. Moreover, the code requires that the contractor's welding procedure and his welders be qualified. In this respect, inspectors of insurance companies, such as the Hartford Steam Boiler Inspection and Insurance Co., and the National Board of Boiler and Pressure Vessel Inspectors, are the "policing agents" for the code. It was also explained how the certified pipe welding bureau provides its members with qualified procedures and how the bureau's local chapters qualify operators.

Certified Pipe Welding Bureau

W. R. Stevens, Cincinnati, chairman of the board of trustees of the National Certified Pipe Welding Bureau, began his report by tracing the development and growth of the bureau since 1944. Several years, he said, were required to change the ASME code to permit the interchange of welders on a national basis, and during these same years three welding procedures were qualified. At the present time, the bureau has over five qualified procedures.

In stressing the advantages which membership in the bureau provides, Mr. Stevens mentioned that $10,000 has been appropriated to develop the procedures for welding stainless and aluminum pipe. He asked the members present if they, as individual contractors, could afford to spend this kind of money to qualify their procedures. He also reported that there are now 21 local chapters of the bureau but stated that there should be one wherever there is a local piping contractors' association. He urged members to start local bureau chapters now because of the increasing practice of requiring pipe welding to be in accordance with the ASME code and because it takes a year or more for a new chapter to really function.

Qualifying Pipe Welders

At the conclusion of the report, one of the members present brought up the fact that the Brooklyn navy yard and some industrial plants require individual qualification of welders, though the industrial firms generally pay for the qualification. W. W. Murray, Jr., of New York City, reported similar cases where industrial customers insist on individual qualification of welders. In his opinion, the welding bureau has much work to do in obtaining recognition. However, there is no doubt in his mind that a welder, qualified by the bureau, will always pass the tests.

T. C. Yantis, of San Francisco, mentioned that the bureau's local chapter in that area has been in operation about two years and that various local Army and Navy offices are considering acceptance of bureau-qualified welders. Mr. Everhard expressed the opinion that it would be impossible to obtain Army and Navy acceptance on a national basis. This is not too important, he said, because acceptance on a local basis can be obtained.

Recommends High Water Temperatures

Afternoon sessions of the convention were devoted largely to panel discussions. The home heating and radiant panel discussion was one of these and was presided over jointly by K. A. Leitgabel, of Milwaukee, and Peter B. Gordon, New York, chairmen, respectively, of these committees.

Subjects discussed included maximum design water temperatures to be used in conventional forced hot water heating systems, metal to metal expansion noises in connection with convectors and finned surfaces, wall streaking with baseboard panel units, and the maximum length of run recommended for cast iron baseboard units.

A number of contractors cited instances where boiler water temperatures have been carried as high as 260 F. Mr. Leitgabel expressed the opinion that "today's competitive market" makes mandatory every possible saving and in his opinion design conditions to produce 240 Btu per sq ft of radiation are practical.

In regard to expansion noises, many of the members present agreed with H. E. Anderson, Chicago, that a practical way to overcome the difficulty is to use continuous pump operation in conjunction with controls which modulate the water temperature in accordance with outdoor temperatures. A less expensive answer to this problem is continuous pump operation (or nearly continuous operation) as provided by a reverse acting aquastat, with the room thermostat controlling the burner. A number of contractors present said they had used this method many times. In connection with expansion noises in forced hot water heating systems, Mr. Leitgabel felt that zoning of systems, particularly where finned surfaces are used, would tend to make matters worse.

Wall Streaking Problems Overcome

The consensus of the group seemed to be that manufacturers of baseboard panel units have, in their present designs, overcome the problems of wall streaking. E. R. Teske, of Chicago, said that the formerly accepted water temperature limit of 200 F is no longer a criterion, and he cited a number of instances where temperatures up to 250 F have been used without wall streaking difficulties.

No one cared to hazard an opinion as to the maximum length cast iron baseboard panel runs should be installed. A number of the contractors said that cast iron baseboard panel units should not be used in connection with series loop systems.

Air Conditioning Systems Described

The air conditioning and refrigeration panel discussion was conducted by W. S. Bodinus, Chicago. Features, advantages and applications of three types of air conditioning systems were outlined by three speakers.

Arthur Meling, of Syracuse, said that packaged or self contained air conditioners are virtually foolproof today and in many instances, carry a five year warranty. He stressed that both compressor and air noise levels have been greatly reduced during the last few years so that it is now practical to use this type of unit in churches and similar applications where low noise level is of great importance.

Advantages he mentioned are that special techniques, knowledge and skill required for installing refrigerant piping, dehydrating and charging systems have been virtually eliminated. In preparing a bid, the contractor is in a fortunate position because a relatively large percentage of the total cost of the job represents a definite item of known cost, he said. Mr. Meling showed slides illustrating numerous types of commercial installations, particularly in existing buildings.

M. S. Lebair, of Philadelphia, described fan-window units which incorporate heating and cooling coils, air filters, and fans with two or three speed motors. Fed by a chilled water system, these units are arranged so as to take in outside air through wall openings, the ratio of outside to recirculated air being controlled by dampers.

He pointed out that this type of system can be combined with a pressure duct system handling outside air, thus eliminating the necessity for wall openings.

J. E. Salmon, of Chicago, described the high pressure duct system as particularly applicable to multistory buildings for year 'round use. He emphasized the saving in space requirements which this type of system provides, its adaptability for zoning (particularly with respect to sun loads) and how it may be used in the modernization of buildings.

Solar Heating Is Described

A scheduled talk of considerable interest was that by A. L. Hesselschwerdt, Jr., assistant professor of mechanical engineering at Massachusetts Institute of Technology. He reported on the research work done and some of the results obtained in connection with the M.I.T. solar house.

After describing early methods of attempting to utilize solar energy in the power field, he stated that research emphasis today is on the use of this energy for space heating. He described a solar heating system as consisting of four elements: collection of energy, transporting energy to storage, storage of energy, and transfer of heat energy to the space. Some of the many factors which influence the design of a solar system are the type of collector, the angle of tilt, the transport fluid used, the type of storage system, the degree of automatic control desired, and the extent to which auxiliary heat should be used. He said that all of these problems have been worked on for some years, but that doesn't mean they have been solved from the standpoint of economic competition.

The system in the M.I.T. solar house uses a flat plate type collector set in the sloped roof and a 1200 gal storage tank in the attic sized to handle the heating load for two sunless days. The storage pump was controlled to operate only when the temperature of the dry collector was 5 deg above the storage tank temperature. Moreover, water in the collector was automatically drained into the storage tank each time the storage pump was shut down.

According to Professor Hesselschwerdt, the solar system handled 74.1 percent of the net heating load during the 1949-1950 heating season, 75.4 percent during 1950-51, and 82.3 percent during 1951-52. Results to date indicate that (1) solar systems for space heating can be successful, (2) to compete economically, much work remains to be done, (3) the design cannot be done by rule of thumb and the system requires extremely close cooperation between the architect, engineer and contractor. In his opinion, the design of the energy transport system is extremely important, particularly from the standpoint of low pumping costs.

Progress in Fight on Bid-Shopping

The report of the committee on legislation, given by Chairman Fred Williams, of Boston, indicated progress in the campaign to institute bidding reforms and the issuance of ceiling price regulations which can be understood and with which contractors can comply. He said that attempts to comply with ceiling price regulation No. 34 created so much confusion that the association, working with other interests in the construction industry, spent much time and effort in promoting a practical regulation. Mr. Williams said that it was due to this activity that a construction industry stabilization commission was created and given full power over the construction industry. Ceiling price regulation No. 93, issued by the OPS last November, set

a definite pattern by which contractors' ceiling prices may be determined.

Growing interest in several states relative to fair bidding practices was reported. In Massachusetts, a bill was introduced in last year's session of the legislature which called for the direct separation of the three mechanical contracts. Though the bill was not passed, a similar measure has been presented to this session and, as of the time of this report, has again been reported favorably by the committee on state administration.

The HPACCNA's Boston association sponsored a fight to aid subcontractors whose money was being withheld by certain general contractors and for whom there was no form of relief other than court action. As a result, the state commission on public buildings will insert in future specifications and contracts a provision specifying when and how subcontractors are to receive payment from general contractors.

An Atlanta group, headed by the Atlanta HPACCNA association, has prepared a measure introduced in the 1952 Georgia general assembly which provides for separate plans, specifications and contracts for (1) general construction, (2) heating, ventilating and air conditioning, (3) plumbing, and (4) electrical installations. The bill was said to have received a favorable report out of the legislative committee.

In January of last year, the national associations of the three mechanical trades formed a liaison committee for the mechanical specialty contracting industries. As the result of numerous conferences, and much work, Senate bill S.2907 and a companion House bill, H.R. 7819, were drafted and introduced. These bills contain provisions whereby any saving to the general contractor, because of substitution of a subcontractor and reduction of price, cannot be claimed by the general contractor but must be turned back to the federal government. Those present were asked to write to their congressmen urging passage of these bills.

Boiler Testing and Rating Codes

As chairman of the boiler output committee, George P. Nachman, of Cleveland, reported that two issues of the association's net load recommendations have been published during the year. Additional new listings of older manufacturers have been added, as well as some for newer manufacturers. Some progress on developing testing and rating codes for boiler-burner units was reported. Last November, the committee held a meeting with the technical committees of the Steel Boiler Institute and the Oil-Heat Institute. The group agreed to cooperate in the preparation of the proposed codes, and the test code is now under way. The much more difficult task will be the rating code, and the securing of general industry agreement.

In his report to members of the association, Secretary Joseph C. Fitts mentioned that the construction industry stabilization commission had announced a formula for wage increases which reflects its policy for 1952 and which was approved by the Wage Stabilization Board last March. The present formula approves an increase of 10 percent over the wage rate of June 24, 1950, plus 15 cents per hr cost of living increase, plus 7½ cents per hr payment to a welfare fund. It was emphasized that this is simply a statement of what the commission will approve. The matter of wages, hours and welfare funds is still a subject for collective bargaining in local areas between "traditionally recognized bargaining units."

Realizing that the commission's inclusion of welfare funds in its formula would lead to demands for the establishment of such funds, a special HPACCNA committee (consisting of the secretaries of three local associations, each of which has been operating welfare funds with local unions) was appointed to prepare a bulletin on welfare funds for distribution to local associations.

Other association business and activities were covered in additional committee reports, such as those dealing with industrial relations, membership, research, standards, home heating, and publication. In addition, a stimulating talk was given during the last session by Dr. Daniel L. Marsh, chancellor of Boston University, who described the school house, the town hall and the church as "foundations of the Republic".

W. W. Murray, Jr. Is New President

The new officers of the HPACCNA are: president, W. W. Murray, Jr., New York City; vice president, R. W. Lawinger, Chicago; and treasurer, J. DeWitt Morrow, Houston. Directors elected to serve three-year terms are A. S. Ford, Boston; H. W. Goldner, Philadelphia; George Hall, Madison, Wis.; Edward Jungbert, Coral Ridge, Ky.; and President Murray.

[An article in the July HPAC summarized other reports and talks given at the HPACCNA's meeting.]

SMA Stresses Importance of Commercial Market

THE 35TH ANNUAL meeting of the Stoker Manufacturers Association (national trade organization of makers of domestic, commercial and small industrial mechanical and automatic coal burning equipment) was attended by 70 representatives of stoker manufacturers, allied supply firms, and allied industries.

C. T. Burg, retiring president of the association, said that "never in the history of the stoker industry has there been so great a need for aggressive merchandising and thorough selling."

The great importance of the commercial and small industrial plant market to both the bituminous coal and stoker industries was high-lighted in the presentation on the bituminous coal industry's advertising, sales promotion and public relations program by Ralph C. Mulligan, of the Bituminous Coal Institute, a department of the National Coal Association, and his associates, Harold Douglas of the Benton & Bowles advertising agency, and James Cunningham, administrative assistant in the BCI program.

LeRoy C. Dubs, Canton Stoker Corp., was elected SMA president; B. O. Fink, Auburn Foundry, Inc., was named vice president; and Howard B. Scoville, Cotta Transmission Co., was chosen secretary-treasurer. Marc G. Bluth was reappointed executive secretary.

Mr. Fink was chairman of the 1952 annual meeting committee and was assisted by Allen Butler, Perfex Corp., and Mr. Bluth. Unfortunately, Mr. Fink was unable to attend.

Steam Utilities in Good Shape

. . . . . but high costs prevent needed expansion in some areas. Efforts to improve design and operation and reduce waste needed

By John F. Collins, Jr.
Secretary-Treasurer of the NDHA

DISTRICT STEAM UTILITIES are in a somewhat better financial position than they were a decade or more ago, hope to reward their owners more satisfactorily in the future, and competition from "private plants" is not as great as it used to be, according to reports given at the 43rd annual meeting of the National District Heating Association, held this year at Skytop, Pa. However, high costs of materials, equipment and labor are preventing needed expansion in some areas, and renewed efforts to improve design and methods of operation — and to eliminate waste — are needed.

Because of increased costs of materials and equipment, the building of steam generating capacity and the extension of district steam distribution systems was somewhat curtailed in 1951. There was only a 1 percent increase last year in distribution piping in use (as measured in square feet of external pipe surface) and but a 3 percent increase in capital investment.

In 18 cities there was insufficient boiler capacity to add customers; in only three of these are there present plans to install more capacity in 1952. Eight utilities added 405,600 lb per hr of capacity in 1951, compared to 655,000 lb in 1950. Six utilities plan to add 575,000 lb of capacity in 1952.

Twenty-five utilities did extend their distribution systems in 1951 and 14 plan to do so this year. But the eight utilities without enough distribution facilities to add customers will not extend them at present because of uncertainty regarding conditions.

A recommendation was made that the NDHA's distribution committee be assigned the task of exploring further the possibilities of designing less costly piping installations.

Investment per dollar of income decreased in 1951, as the steam suppliers continued to utilize spare capacity and connect to their lines favorably-located buildings.

Operating costs also continued at a high level in 1951. Wages and the number employed in the industry increased — resulting in an average increase in total hourly wage cost of 6.1 percent.

Unit fuel costs reached at least a temporary peak. The cost of coal per million Btu showed a decrease in 1951 for the second consecutive year. However, other fuels — except electricity and gas — showed an appreciable increase in cost per million Btu.

There was a disconcerting 3.8 percent increase in steam loss per sq ft of pipe surface. Plans were made to attack this problem with increased vigor in 1952.

Downward Trend in New Business

The downward trend in new district steam business which began in 1949 continued in 1951. Revenue from new business was the lowest of any year since 1945 and was 72 percent of the 1948 peak year. However, the loss was not universal; in 33 cities there was a decrease in new business compared with 1950, and in 18 there was an increase.

In 47 cities, 349 new customers were connected. These properties will require 1,919,670 M lb of steam per year and will bring in a revenue of 2,271,700 or $1.18 per M lb. In 13 cities there were no new customers. Seventy-four new customers in New York accounted for 20 percent of the total new business and 225 new customers in five cities — New York, Philadelphia, Detroit, Boston and Rochester (N.Y.) — accounted for 53 percent of it.

It is interesting to note that 513 (60.4 percent) of the new contracts in 1951 were for old buildings being connected to the steam lines for the first time; 173 (20.4 percent) were for old buildings begin reconnected after a period without service, and 163 (19.2 percent) were for new buildings.

The residential group (including hotels, apartments, clubs, hospitals and homes) accounted for the largest amount of new business. The office building group was second in steam consumption and revenue.

Steam sold in 1951 for air conditioning new business in three cities — New York, Philadelphia and Harrisburg, the only ones to report — totalled 50,000 M lb.

There was an increase in total steam sales over 1950 of 3.9 percent, accounted for mostly by the increase in connected load since the number of degree-days was about the same each year.

The number of customers lost and the total revenue lost were both less in 1951 than in 1950. In seven cities a total of 54 customers were lost — generally the result of a de-

sire to reduce costs. The loss was $188,350. Eighty percent of the loss occurred in a single city. In 40 cities, no customers left the lines.

Heating rates in many cases have not kept pace with increasing costs and taxes. While — according to the NDHA — net earnings are too low and there is little competition, the steam utilities have not raised their prices proportionately to other industries (such as the automotive industry, for example, has done under similar circumstances.) Many utilities have raised their rates to some extent and others are now contemplating this form of relief. One of the difficulties is that when rates are raised and bring in more income, a large percentage must be passed on as taxes and the utility does not benefit to the extent of the customer's increased cost. Taxes are low only when the earnings on which they are based are small.

Heating Utilities "In the Black"

Total revenue in 1951 increased 6.1 percent over 1950, with 17 utilities reporting a decrease. The average revenue or rate per M lb of steam sold increased 1.7 percent, with 21 companies reporting a decrease. The ratio of fuel cost to revenue improved 0.7 percent over 1950.

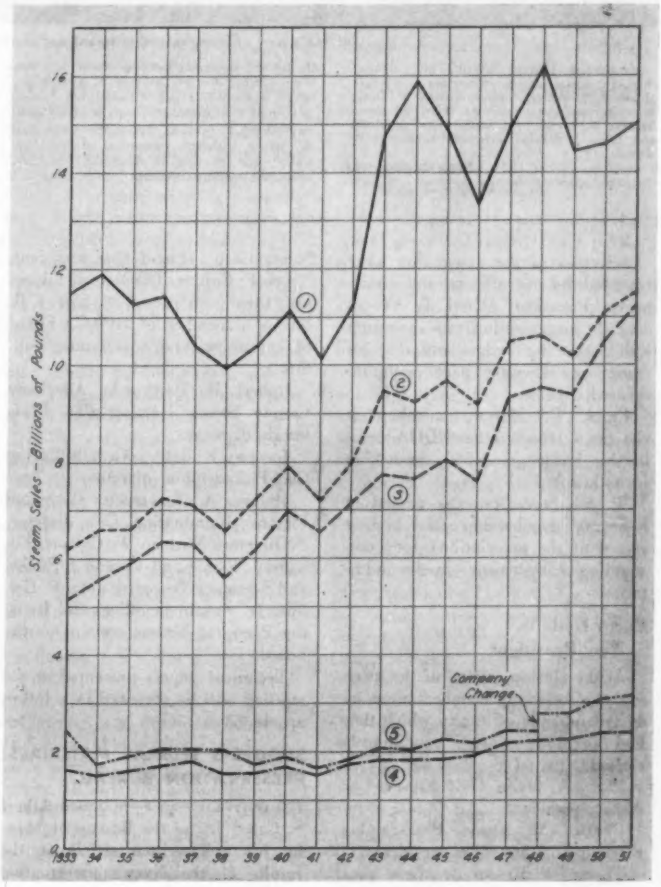
A decade ago the heating utilities were all — or nearly all — in the red. Net earnings have improved and now all are in the black (at least a little way.) Some managements are easily satisfied or have got used to being considered "the poor relation" but others feel that earnings comparable with those of the sister electric industry should not be looked on as excessive and should be the objective for the future.

Eighteen years ago the competitive situation was recorded in the association records. It was much more serious then than now. The price of fuel and operating labor was much lower then in private plants. A rapid advance had just been made in small size stoker design. There was great cooperation between the various groups supplying equipment to the private plants. The intangible advantages of district heating were disregarded by building owners and they looked askance at the claims of the utility engineers.

In the interim, private plant costs have tended to rise faster than have district steam rates. Fuel and labor rates have doubled, while steam rates have increased 50 percent or less. The private plants have had difficulty in obtaining competent and reliable labor. It is often difficult to operate them without violating the recent smoke ordinances and these also necessitate additional plant investment. Intangibles are now evaluated and the statements of the utilities are accepted because they have been found reliable over the years.

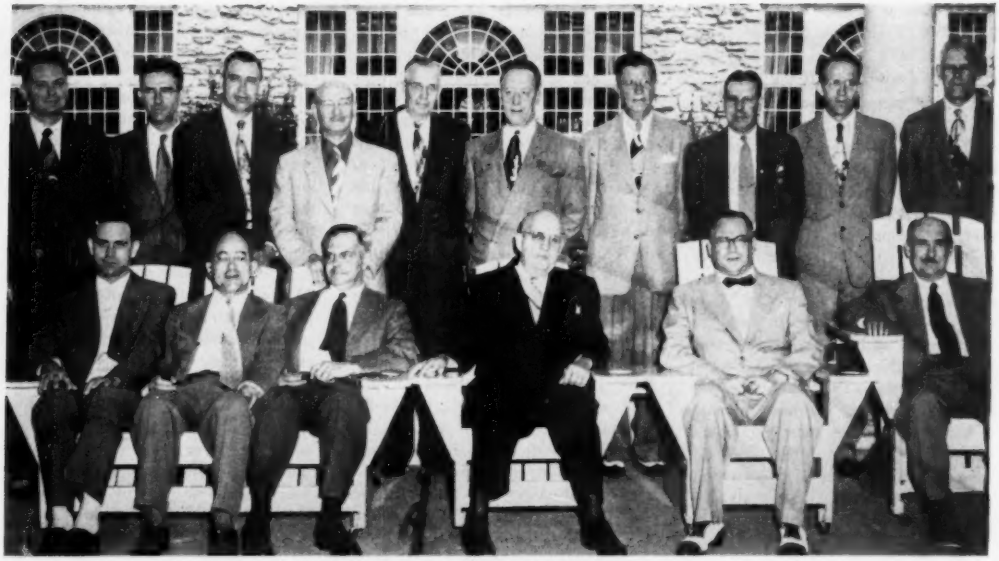
In 1951, the most competitive fuel in six cities was bituminous coal, costing 62 percent of the price of purchased steam; in two cities was anthracite coal, costing 84 percent of the price of purchased steam; in three cities was oil, costing 53 percent of the price of purchased steam; and in two cities was gas, costing 43.5 percent of the price of purchased steam. The average fuel cost was 60.5 percent of the price of purchased steam.

District steam now is well recognized as a method of heating downtown buildings just as electric service is generally accepted. Semi-automatic district heating is now more attractive than at any time in the past, the NDHA believes.



TREND OF ANNUAL steam sales for 20 of the larger steam utilities. The utilities represented in the curves are:

Group No.	Companies
1	New York.
2	Detroit, Rochester, N.Y., Cleveland, and Boston.
3	Milwaukee, Dayton, Philadelphia, Pittsburgh, St. Louis and Baltimore.
4	Portland, Chicago and Kansas City.
5	Lansing, Winnipeg (Hydro), Peoria, Spokane, Erie and St. Paul from 1933 to 1948. Toledo and Akron from 1948 on.



NDHA's new officers, executive board and chairmen

Seated, left to right: Walter M. Gillespie, chairman, steam station engineering committee; Homer A. Lawrence, director; Charles W. Deeg, first vice president; Percy A. Hyde, president; Thomas P. Brown, Jr., second vice president; and Julius J. Schenk, chairman, advisory committee.

Standing, left to right: Foster L. Stephens, chairman, operating statistics committee; William G. Gillim, chairman, metering committee; Vernon J. Suche, director; Norman W. Calvert, director; Edward J. Flahie, director; Leo F. Collins, third vice president; Joseph Kildare, director; Alfred T. Veness, retiring president; Carl W. Signor, chairman, commercial relations committee; and Norman H. Davidson, chairman, sales development committee.

Absent when photo was taken: John F. Collins, Jr., secretary-treasurer; Robert B. Donworth, director; David W. Loucks, chairman, educational committee; Frank B. Mahon, chairman, membership committee; Robert D. Martin, chairman, air conditioning committee; Clifford O. Thurlow, chairman, rates and regulations committee; and Robert C. Wilson, chairman, steam losses committee.

Activities of the association were reported by its officers and chairmen. President Alfred T. Veness said the organization was operating well within its budget and that income was keeping pace with increased expenses.

Frank B. Mahon, membership chairman, reported that NDHA membership had reached 560, the largest in its history.

W. W. Stevenson was named to honorary membership (the highest award of the association) for "outstanding achievement" in the industry.

Percy Hyde Is New President

At the closing session of the meeting, the following members were inducted into the offices to which they had previously been unanimously elected.

Percy A. Hyde, Ohio Edison Co., Akron, president.

Charles W. Deeg, Philadelphia Electric Co., first vice president.

Thomas P. Brown, Jr., New York Steam Corp., second vice president.

Leo F. Collins, The Detroit Edison Co., third vice president. (Mr. Collins is a member of HPAC's board of consulting and contributing editors.)

Robert B. Donworth, Allegheny County Steam Heating Co., Pittsburgh, director.

Joseph Kildare, Yarnall-Waring Co., Philadelphia, director.

Homer A. Lawrence, Cleveland Electric Illuminating Co., director.

Directors Norman W. Calvert, Edward J. Flahie and Vernon J. Suche, and Secretary-Treasurer John F. Collins, Jr. remain in office, and Retiring President Veness remains on the board.

Technical papers presented at the meeting will be reviewed in a future article.

SUGGESTS FEDERAL MATERIALS PRESERVATION BUREAU

I SHOULD LIKE TO compliment Albert S. Gates, Jr., of the Bureau of Ships for his well written article on the results of the Navy's preservation and dehumidification program, the first part of which was published in the July HPAC.

The U. S. Navy has done more research and experimenting to develop proper preservation techniques than any other branch of the Government or any of the larger industrial concerns.

With the greatly expanded military procurement program, it is a matter of utmost importance to see that proper measures are taken to preserve equipment that will be placed in long-term storage.

It is my opinion that a central U. S. Government Materials Preservation Bureau should be organized and directed by a few men in the Navy and the Army, who have gained experience in applying these new techniques, not only for ship preservation but for warehouses and hangars as well — to the ultimate benefit of the Nation's strength and (not to forget) the taxpayer.—GUNNAR C. F. ASKER, Vice President, Desomatic Products Div., Daly, Merritt & Sullivan, Inc.

Silencing Cooling Towers

The noise from cooling towers can be controlled by means of accurately engineered silencing equipment — taking into account the necessity of attenuating both low and high frequency sound waves. Mr. Hirschorn explains some of the design techniques, using an actual example of a tower on a hotel roof

By Martin Hirschorn

President, Industrial Acoustics Co., Inc.

COOLING TOWER NOISE control has developed in the last few years to be a problem of increasing importance. Objectionable noises created by air conditioning cooling towers installed in confined spaces close to hotel rooms, residential apartments or offices have led to threats of law suits and have caused considerable inconvenience to their owners and others.

An important aspect of the noise control problem is that, for a small cooling tower, the "acoustical correction" may exceed in cost that of the cooling tower itself; for large cooling towers, the silencer cost is likely to amount to a very substantial fraction of the total cost. The cost of such cooling tower silencing can be reduced by planning for it when the tower installation is being designed.

Sources of Noise and Its Transmission

Cooling tower noise is caused principally by the following factors:

1) Periodic pulsations imparted by the fan rotation on the air and also air turbulence caused by fans with high tip speeds.

2) Dripping of water into the basin.

The fan noise is a function of the fan speed and the number of blades on the rotor; this noise is therefore likely to have low frequency characteristics, whereas air turbulence will contribute higher noise frequency bands. The fan noise is usually predominant, though in some types of cooling towers the water dripping will produce more noise than will the fan. In a large cooling tower installation, occupants in rooms located over the fans may complain about fan noise and occupants of lower rooms may complain about water noise. Nevertheless, whichever noise is predominant, it will usually be necessary to silence both the cooling tower air intake and discharge ends.

Noise from the cooling tower can be transmitted by means of the following media:

1) The air intake louver (water noise usually predominant).

2) The air discharge louver (fan noise usually predominant).

3) The walls of the cooling tower (fan and water noise).

4) The circulating water pipe lines (due to circulating pump in basement or transmission from cooling tower).

5) Vibration transmission from motor and fan base (structurally transmitted noise).

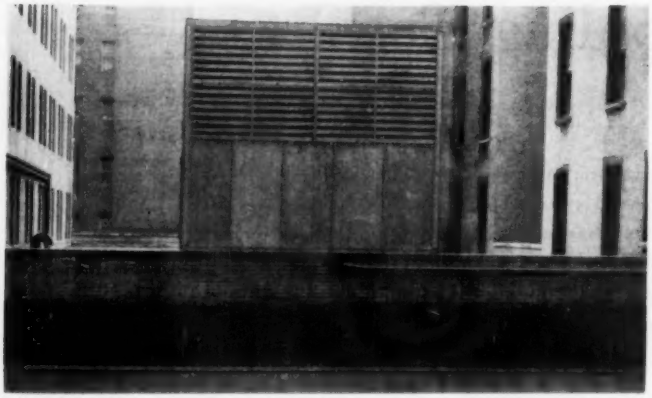
All these five avenues of noise transmission can cause a great deal of trouble and must be considered carefully when planning the tower installation. An otherwise effective installation of air intake and discharge silencers can be rendered ineffective if the attenuation through the wall structure is not at least equal to that through the silencers. The problem of water pipe noise has been dealt with in a previous paper [see Reference No. 1.] Vibration transmission through the foundation due to the fan and motor can be prevented by mounting the complete fan and motor base on suitably loaded vibration isolation mounts.

Air Intake and Discharge Silencers

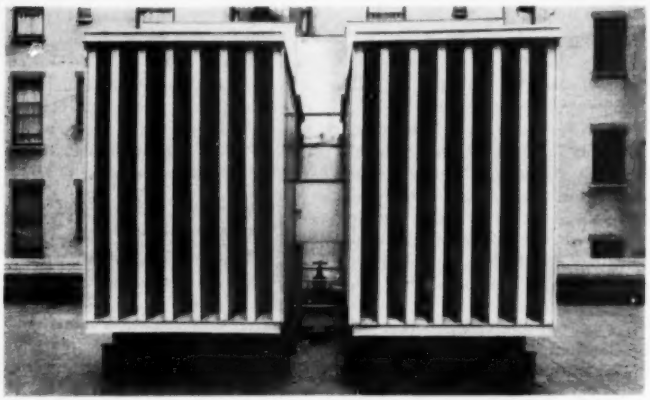
It is comparatively well known that sound absorbing materials are particularly effective in absorbing high frequency noises but do a rather poor job in absorbing low frequency noises. Since low frequency noises usually contribute a high degree of sound pressure in the cooling tower noise spectrum, it is necessary to provide special silencing devices, such as acoustic filters [Reference No. 2] or low frequency resonators, in order to assure effective attenuation. A silencing installation employing low frequency resonators will be described here.

The accompanying photos show the front, rear and side views of a silencing installation — consisting of an air intake silencer and an air discharge silencer with low frequency resonators — on the roof of a hotel. The cooling towers involved are two of 50 ton capacity, each having 5 ft diameter fans with four blades rotating at 580 rpm and moving 15,000 cfm.

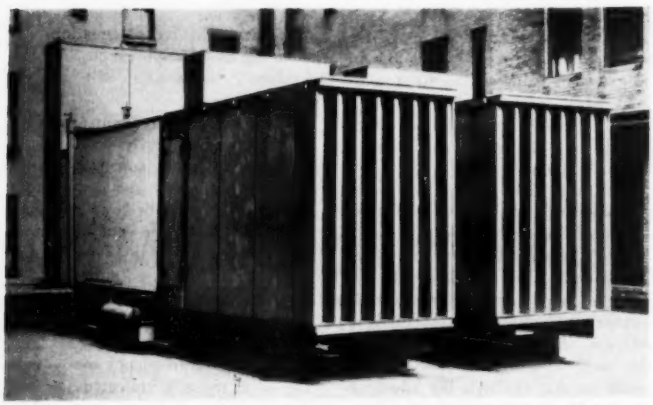
The original frequency spectrum of the tower noise is indicated as Curve No. 1 on the chart, as measured by means of an octave band analyzer.



COOLING TOWERS for air conditioning installed in confined spaces — such as this one on a hotel roof — cause a lot of trouble when they create objectionable noise



HERE'S AN END VIEW of the air discharge silencer on the hotel cooling tower. The preceding illustration is a front view showing the air intake silencer



SIDE VIEW of the silencer installation, showing the resonators projecting from the discharge silencer near the cooling tower

It will be noted that all frequencies from 20 to 10,000 cps contribute a noise pressure in excess of 65 db. The strongest components are in the range of from 300 to 4800 cps; the low frequency bands of from 20 to 300 cps are of the order of 69 db to 73 db. These low frequencies are the most difficult ones to attenuate. In order to obtain attenuations of 10 db or more in these frequency bands, low frequency resonators were provided. The resulting noise spectrum is shown in Curve No. 2 of the same chart, and it is still somewhat in excess of the ambient or masking noise level because of cooling tower wall transmission.

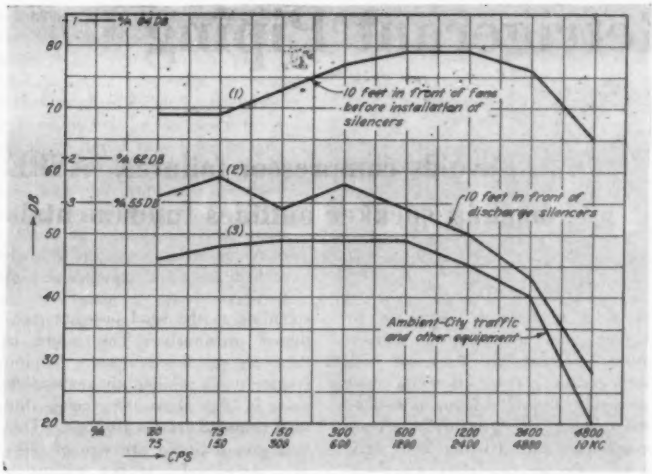
Intake and discharge silencers are designed with sufficient attenuation in order to make Curve No. 2 coincide with the ambient Curve No. 3, provided that the cooling tower walls are acoustically treated. In the present case, an overall noise level reduction of 22 db (from 84 db to 62 db) was achieved — which amounts to a loudness reduction of 88 percent as calculated by a new method which converts the sound pressure of the various octave bands into loudness units [see Reference No. 3]. In the apartment of one of the complaining tenants, the overall noise level was 55 db with the cooling tower in operation and thus coincided with the ambient level. The benefit of this additional reduction of 7 db can be attributed to the operation of the "distance inverse square law", which in this case made it unnecessary to treat the cooling tower walls.

The calculated pressure drop through the air intake and discharge silencers is less than 0.01 in. of water.

Low Frequency Resonators

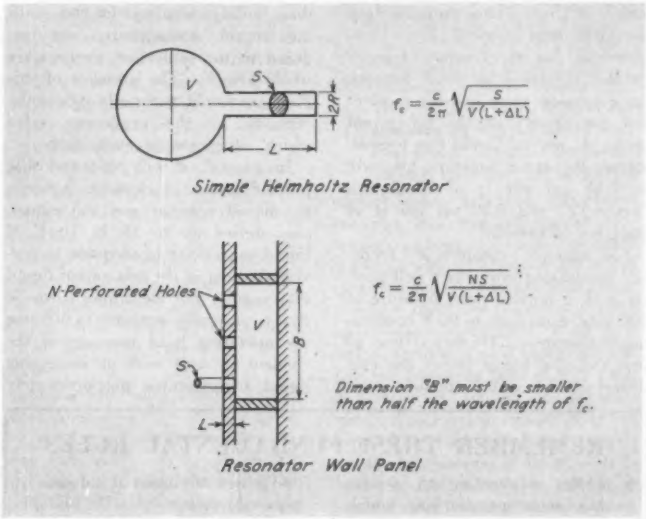
The principle of the low frequency or Helmholtz resonators as used in the present installation is as follows:

A simple Helmholtz resonator is indicated in the accompanying sketch; it consists of a volume chamber (V) with a connecting channel of length (L) and radius ($2R$.) The air mass in the connecting channel can be considered as practically incompressible and on excitation will move like a piston compressing and rarefying the air in the larger volume chamber. The air in the chamber provides a stiffness element similar to a spring. The energy dissipated



COMPARATIVE NOISE OCTAVE band spectra for the cooling tower installation shown in the photos

O/A stands for overall noise level and represents the resultant sound pressure of the various octave bands shown on the graph. The sound pressure of each octave band must be lower than the overall sound pressure.



A SIMPLE HELMHOLTZ (or low frequency) resonator and resonator wall panel, the principle of which is briefly explained in the text

by this movement of the air in the chamber will result in a reduction of the sound energy for the particular frequency for which the resonator has been dimensioned. The resonating frequency of a simple resonator can be calculated as follows:

$$f_c = \frac{c}{2\pi}\sqrt{\frac{S}{V(L+\Delta L)}}$$

where f_c = frequency, cycles per second; c = velocity of sound in air, ft per sec; V = volume of air space, cu ft; S = area of connecting channel, sq ft; L = length of connecting channel, ft; ΔL = end correction factor, usually about $0.6R$, where R is the radius of the connecting channel.

The correction factor $\triangle L$ arises out of the fact that some of the gas beyond the channel constriction moves as a unit with the gas in the channel, and this has the effect of increasing the length of the channel. For practical applications, resonators can be designed for frequencies in the range of from 40 to 400 cycles per second. The attenuation of a tuned resonator can exceed 30 db. Resonators can be designed in various shapes and combinations to suit the requirements of any particular silencing job. In the present case, the resonators were designed so that they could be adjusted for tuning on the job in order to assure maximum attenuation. [For a fuller discussion of the theory of the Helmholtz resonator, see Reference No. 4.]

References Cited in the Text

1) Eliminating Noise Transmission in Liquid Lines, by Martin Hirschorn, Heating, Piping & Air Conditioning, March 1952.

2) Design of an Equipment Silencer, by Martin Hirschorn, Chemical Engineering, September 1949.

3) Instrumentation and Techniques for Measurement and Evaluation of Industrial Noise, by Daniel B. Callaway, Vol. 2, p 64, Proceedings of Second Annual National Noise Abatement Symposium, October 5, 1951.

4) Fundamentals of Acoustics, by Lawrence E. Kinsler and Austin R. Frey, John Wiley & Sons, Inc., page 199.

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Steam for rent: When General Tire & Rubber's Baytown, Texas, plant had the problem of getting enough processing steam to keep up production (all three boilers had to come off the line for repairs), they rented a packaged steam generator from the Texsteam Corp., according to the Vapor Heating Corp. The 22,000 lb per hr steam generator was shipped on one truck, installed in a few hours on a previously poured concrete base.

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Snow data: While not published with the objective of presenting data on snow melting, Housing Research Paper No. 19 of the Housing and Home Finance Agency (available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D.C., for 20c) reports snow load studies, includes information on maximum water equivalent and seasonal snow fall, estimated weight of the seasonal snow pack, controlling snow storms, etc.

Right Refrigerant Piping

. . . . . avoids compressor failures. ASRE meeting speaker outlines fundamentals

At the American Society of Refrigerating Engineers spring meeting, C. W. Leegard (of General Electric's air conditioning division) explained fundamentals of refrigerant piping for "Freon-12" and "Freon-22" systems. Excerpts from the paper (which was prepared in collaboration with the late Wayne E. Dodson) are given here.

MANY COMPRESSOR failures are caused by poorly designed refrigerant piping systems. The number of broken compressor valves and burned out compressors can be reduced if bad piping practices are avoided.

Flash Gas Reduces Capacity

The problems of oil return and traps in the line are not a source of trouble in liquid lines as they are in suction and discharge lines, because the liquid refrigerant and oil are miscible in "Freon" systems. In other words, the oil and refrigerant will mix in all proportions and will not become separated while the refrigerant is in a liquid state.

A major consideration when designing a system is that the liquid refrigerant should reach the expansion device with at least 1 deg of subcooling. The presence of flash gas or vapor in the liquid line will materially reduce the capacity of the expansion device (such as an expansion valve) and will therefore cause erratic control of the liquid entering the cooling coil. Flash gas will result where liquid is not subcooled below the saturation temperature corresponding to liquid pressure found at the expansion device.

The liquid refrigerant as it leaves the condenser or receiver normally is at a temperature equal to or higher than the ambient temperature and therefore does not flash into gas as a result of temperature increase. Liquid flashing is usually the result of pressure decrease caused by line friction and static head. Proper line sizes are therefore indicated to control these factors.

The friction pressure drop depends on capacity, line size and length of lines. This pressure drop should be kept below 5 psig. Pressure loss due to elevation depends on the difference in level between the expansion valve and the receiver and the density of the refrigerant used. At normal liquid line temperatures, the static pressure loss will be 0.55 psi per ft of head with "Freon-12" and 0.50 psi per ft of head for "Freon-22."

For example, consider a "Freon-12" condensing unit which will operate with a normal head pressure of 100 psig, equivalent to 90 F condensing temperature. On this system we find that the liquid leaves the condenser at 85 F with a pressure corresponding to the head pressure mentioned previously. The liquid is therefore subcooled 5 deg. If pipe friction is 5 psi and the expansion valve is 10 ft above the receiver, the total pressure drop is 10½ psi. This will give a liquid pressure of 89½ psi immediately at the expansion valve. Since the temperature of saturated refrigerant at this pressure is a little over 83 F, some of the liquid would flash into gas and this boiling would continue until the liquid temperature was reduced to the saturation temperature of 83 plus F. The presence of this flash gas would materially reduce the capacity of the expansion valve which, of course, is undesirable.

In general, it will be found that for differences in elevation between the liquid receiver and the expansion device up to 15 ft, 10 F of liquid subcooling is adequate to prevent flashing of the refrigerant liquid into vapor. For elevations 15 to 30 ft, it is generally necessary to increase the operating head pressure of the condensing unit without increasing liquid temperatures proportionately

REMEMBER THESE FUNDAMENTAL RULES

EVERY REFRIGERATION system has some peculiarities which must be taken into consideration when laying out piping systems and control elements. The fundamental rules for guiding installation practice may be summed up as follows:

1) Liquid refrigerant with little or no flash gas should reach the expansion device.

2) Discharge gas must be taken from the compressor to the condenser without trapping out excessive amounts of oil and with a minimum of induced pipe vibration.

3) Vaporized refrigerant must be returned to the compressor in a manner to insure return of entrained oil in a metered measure so that the compressor will not be injured or robbed of oil.

4) Proper control of refrigerant to the cooling coil during both "on" and "off" cycles is extremely important.

5) A refrigerant compressor is a gas pump and not a liquid pump.

and, in addition, to use larger refrigerant lines to reduce the line friction losses.

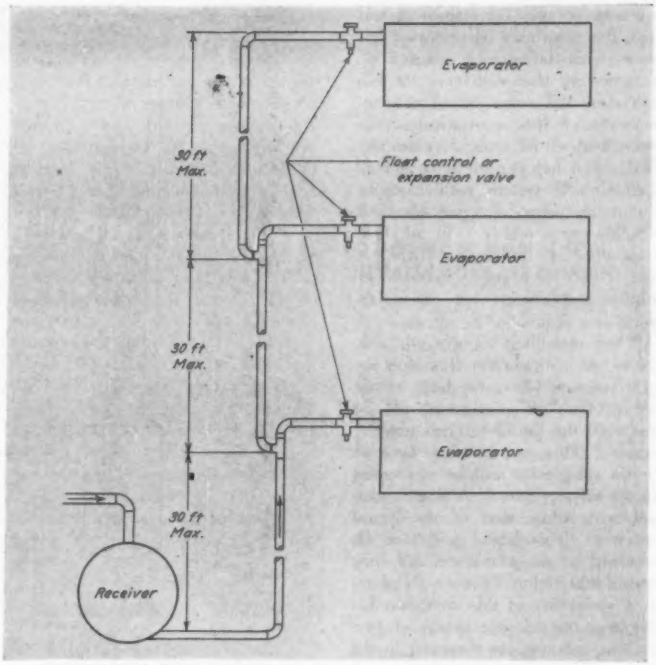
Where liquid subcooling in excess of that obtained in the condenser is required, it will be necessary to use suction to liquid heat interchangers. The heat interchangers should be located near the evaporator to obtain the greatest efficiency.

It may be necessary in some installations to have a number of evaporators at different levels supplied by one condensing unit at a lower level. When elevations between expansion valves and liquid receivers are over 30 ft, it is difficult to prevent gas flashing. In this case the system performance will become poor since flash gas will not only affect the individual expansion valves but also may cause unequal distribution of the refrigerant between the different evaporators.

To correct this trouble from the standpoint of refrigerant distribution, the liquid line is stepped at intervals not exceeding 30 ft. Vapor or gas formed in each leg of the line will tend to go to the nearest expansion valve. This allows each evaporator to receive its share of liquid and gas as the flash gas resulting in one particular leg will go to the first expansion valve; the liquid flashing in the second leg will go to the next one, and so on.

Naturally, the use of a liquid to suction heat interchanger immediately ahead of each one of the expansion valves would improve operation of the valves and of the entire system.

Systems with long vertical liquid upfeed lines should be avoided since they are less efficient and often require abnormal service. As stated previously, the designing of the liquid line is relatively simple and, if pressure drop and static head are calculated so that the normal liquid subcooling realized from the condenser is adequate, no difficulties should be experienced.



THIS LIQUID LINE PIPING arrangement for evaporators installed above a receiver at different levels tends to proportion flow of flash gas to the evaporators. Systems with long vertical liquid upfeed lines should be avoided, since they are less efficient and require abnormal service

Use Care in Design of Hot Gas Lines

When a compressor and condenser are remote from each other, the discharge line must be designed as a component of the system and considerable care should be taken in its design to avoid difficulties.

The discharge lines from the compressor must carry the compressed gas and entrained oil to the condenser without excessive pressure drop and without excessive noise and vibration due to hot gas pulsations.

Where there are compressor units with remote condensers, it is normally considered good practice to design the discharge lines so that pressure drop is limited to approximately 2 psig unless smaller lines are required to obtain satisfactory velocities for entrainment of the oil. It is desirable to maintain a minimum pressure drop because pressure losses increase the power normally required by the compressor motor, decrease capacity of the system, and cause higher wear rates on the compressor.

Pressure drop is kept low by using generous line sizes to avoid line friction. The sizes must be selected so that gas velocities will not be too low to carry entrained oil. Gaseous refrigerant is notoriously poor for carrying oil with it because it is not miscible with oil in all proportions, as it is in the liquid state. We all know that compressors must, and do, pump some oil. This oil must pass on with the refrigerant through the entire system and be returned to the compressor or compressor failures will result because of lack of lubrication.

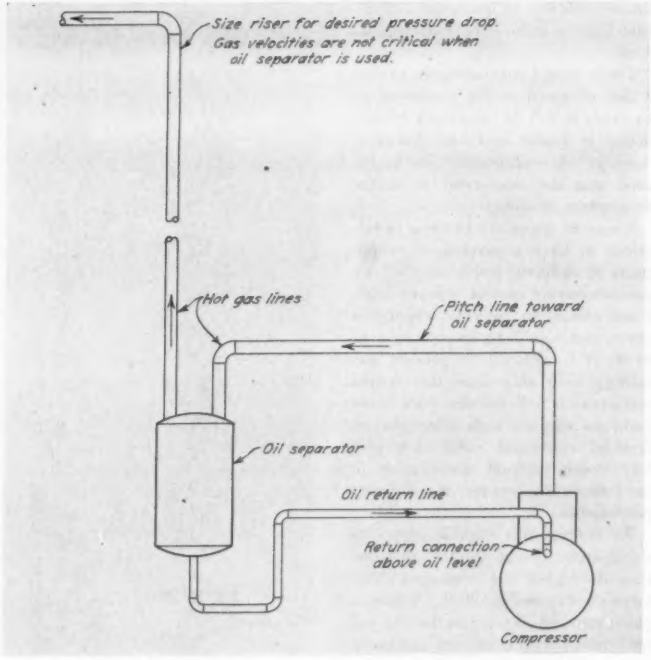
It has been found that discharge gas velocities in vertical risers with upward flow must be at a minimum of 1500 fpm in order to carry along entrained oil. Minimum gas velocities of 750 fpm are generally adequate on horizontal runs. However, such horizontal runs should always be pitched downstream in order to facilitate movement of the oil which is carried along the pipe walls.

When compressors are connected in parallel, it is always good practice to use a Y fitting where the two individual discharge lines join to the common discharge line.

Where the discharge lines are so long that pressure drop is too great with the required gas velocities, an oil separator may be used to good advantage. The oil separator is generally mounted in the discharge line immediately near the compressor and returns most of the entrained oil to the compressor crankcases.

Where hot gas oil separators are used, line sizes may be increased because, with the minute quantity of entrained oil that will leave the oil separator, the velocities of the refrigerant are not as critical as in systems where oil separators are not used. The hot gas oil separator is useful on a system with capacity modulation where the gas flow and velocities vary widely. An oil separator has an additional virtue in that it acts as a surge chamber or muffler and reduces hot gas pulsations.

When installing hot gas oil separators, it is important that they be in a location where the temperature during the "off" cycle will not be less than the liquid receiver temperatures. This is necessary because liquid refrigerant will be condensed in the oil separator if it is at a temperature below that of the liquid receiver. This liquid will then be returned to the crankcase and may cause lubrication failure. If there is a possibility of this condition being encountered, one means of preventing extreme condensation in the oil separator is to install a check valve in the line near the condenser.


Size riser for desired pressure drop. Gas velocities are not critical when oil separator is used.
Hot gas lines
Pitch line toward oil separator
Oil separator
Oil return line
Return connection above oil level
Compressor

OIL SEPARATOR USED to return oil where vertical hot gas velocities fall below 1500 fpm during minimum load. Avoid installing compressor, oil separator and hot gas lines where low temperatures will condense refrigerant and allow it to drain into the oil separator and be returned to the compressor crankcase. A check valve at the condenser inlet will limit the amount of refrigerant that can be condensed

Suction Lines Most Critical

The design and construction of suction lines is the most critical problem in a refrigeration system of piping because the suction lines must return refrigerant gas and oil from the evaporator to the compressor during operation of the system and should not allow oil or liquid refrigerant to be returned as slugs at any time, since these can damage compressor valves and cause compressor lubrication failures.

To insure continuous return of oil to the compressor, horizontal lines should be sized to obtain a minimum gas velocity of 750 fpm and the vertical line risers should be sized to obtain a minimum of 1500 fpm gas velocity. In large lines used in extremely low pressure systems, velocities up to 3000 fpm may be required to return oil satisfactorily in vertical risers.

The pressure drop normally considered allowable in the suction line is usually limited to the pressure drop equivalent of a 2 F change in saturated refrigerant temperature. This means a very small pressure loss in low temperature systems because at —20 F "Freon-12" has a pressure change of 0.70 psi for a 2 F saturation temperature change, while at 40 F a pressure change of 1.8 psi is realized for a 2 F refrigerant temperature change. When vertical risers are sized to provide satisfactory minimum velocities, the pressure drop in them is increased appreciably and the horizontal lines must be sized to keep the total pressure drop within the allowable limits. These horizontal lines must be pitched downstream to induce free draining of the piping runs and no long traps or dead ends can be permitted in such lines because oil will separate out and come back in the form of slugs with possible harm to the compressor.

If a pump-out cycle is not used, the line from the evaporator should always be dropped to a short trap having vertical and horizontal dimensions as short as fittings will permit immediately at the evaporator. The reason for this is that the refrigerant and oil remaining in the coil after a cycle can drain into the compressor and cause damage on the next start-up. Suction lines may be installed free draining if a pump-out cycle is used since only the residual oil in the piping can collect at the compressor.

When compressor capacity modulation is used, it becomes difficult to maintain the required gas velocities to return oil properly. If the riser is properly sized for the modulated condition, the increased velocities at full load can cause excessive pressure drop or noisy operation. One means of maintaining velocities with modulated operation is by use of a two-riser system. Each riser is sized so that a 1500 fpm minimum velocity will be obtained when only one coil is in operation. At the reduced capacity, oil will be collected in the bottom trap until one of the risers is blocked off and then the gas velocity will be increased and oil will be satisfactorily entrained up the other riser. An alternate method would be to connect directly across

the bottom of the risers with a solenoid valve. This solenoid valve would be connected with the capacity modulation hookup so that when the compressor capacity modulation took effect the solenoid valve would close and immediately a 1500 ft gas velocity would be obtained up one of the risers.

Traps in the suction line are recommended for parallel compressors but not with single compressors. In single units, where all cylinders are operating at one time and the suction piping is correctly sized, we are concerned only with the oil that collects during the "off" cycle, since all properly installed systems have traps in the suction line near the evaporator. The oil that does collect will be from the suction line only and will normally represent a reasonably small amount which can thus be accommodated by being taken into the intake valve while the compressor accelerates at the start.

With improperly installed parallel units, the problem is changed because of the increased quantity of oil that may be trapped while only part of the units are operating. In this case there are two factors to be considered. First, the amount of oil trapped may be of such quantity as to deprive the compressors of adequate lubrication. Second, the quantity of oil trapped may be much greater than the amount that could be safely taken through the valves when the inoperative unit starts. The use of properly installed traps for parallel units insures that the oil will be continuously returned to the compressors even if some are inoperative. Any oil accumulating from the piping during the "off" cycle will usually be of a small quantity so that when the units are started the gas passing over the oil will entrain oil in small enough quantities to be returned safely.

[The original paper from which these excerpts were taken included 16 figures showing recommended piping schemes.]

Analyzing Heating Plant Costs

THE ARTICLES IN HPAC on the Illinois Institute of Technology heating plant have been quite informative and I read them with appreciation. The April article, however, seems to be designed to improve a condition that in many plants is bad. However, if other places follow this method, the results will be quite misleading.

Admittedly, an analysis of an institutional plant does not need to consider all the costs that are chargeable against a district steam plant (such as advertising, etc.) But the authors have over-simplified. Their chart indicates a profit, whereas it should show a loss approximately as great as its hypothetical profit.

Costs of money, replacement, maintenance and operational labor and materials, at least, should be included in the price of a unit of steam.

The idea of free money is illusory. Even the endowments have cost something, and the money that is frozen in buildings would produce interest if handled differently. At the least, the interest that is not produced by the investment should be in the charges.

Replacement cannot be brushed off as a "rather controversial question", as indicated on page 96 of the April issue. From the moment that fabrication starts to the time the component parts are in transit to be remelted into steel, the building, equipment, etc., are dying. The controversy the authors mention is probably that one between the appraisers and accountants who want an easily handled "straight line" or a "sinking fund" amortization and the engineers who want to approximate the natural "declining balance" method.

Whichever method is used, a depreciation reserve should be set up and the steam that is sold should supply the money.

Maintenance consists of two charges:

1) Those that apply only to the steam going to a structure — branch lines, etc. (which should be billed as a separate item); and

2) Those that are common to many or all of the structures (which should be apportioned).

The rate, then, should be somewhat similiar to the rate they pay for electricity and should show a uniform monthly charge, including the semi-constant costs plus the consumption times unit charge plus maintenance, etc., costs that cannot be apportioned.

Charging in this manner gives an incentive to keep down repairs and to minimize the use of steam. The chart associated with this method of accounting gives a better picture of the costs of running the plant.—JAMES MOORE EVANS, Edwards Air Force Base.

COMPLETE COMBUSTION A KEY TO SMOKE PREVENTION

AT LEAST ONE-HALF and probably three-fourths of the smoke produced in Chicago can be prevented, according to Dr. Walter C. McCrone, senior chemist at the Armour Research Foundation of the Illinois Institute of Technology. "One of the keys to smoke prevention is complete combustion," he says. "A dense black smoke will contain well over 50 percent unburned fuel; under the conditions giving such a smoke you can be sending more than a fourth of your fuel up the chimney unburned."

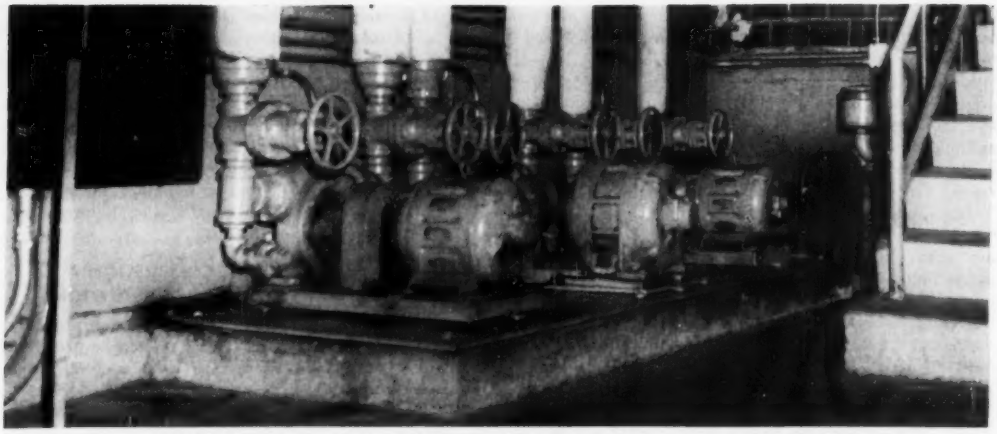
He explains that when smoke is being produced it usually is caused by use of the wrong fuel, poor equipment or bad firing habits. Even with the best fuel and equipment available, though, the results still depend on the ability and vigilance of the man handling the furnace.

Mix Plenty of Air With Fuel in Fire Zone

The important thing, Dr. McCrone asserts, is to see that plenty of air is mixed thoroughly with the fuel in the fire zone. Large furnaces achieve this by use of air jets and other special equipment. Operators of smaller furnaces can get the same effect by adjusting dampers and drafts properly.

It is necessary, he recognizes, to be careful in supplying air to burning fuel because the air has a cooling effect. It also can blow fuel up the chimney before it has a chance to burn. There is for every boiler, he says, a certain amount of air which will give best results.

Dr. McCrone, along with other research scientists at Armour, is engaged in a study of the sources, causes, and prevention of air pollution. The study is sponsored by the Midwestern Air Pollution Prevention Association.



INSTALLING EQUIPMENT larger than is needed can sometimes create more problems than the use of apparently undersized equipment

Don't Oversize Pumps

. . . . . for forced hot water heating systems, or troubles may result

By Harold A. Lockhart and Louis Oosten
Chief Engineer and Assistant Chief Engineer
Bell & Gossett Co.

THE COMMON DESIRE to give more than was bargained for — or to protect against lack of knowledge — by installing heating equipment larger than needed can create more problems than the use of apparently undersized equipment. The proper selection of a circulating pump for a forced hot water heating system depends upon a correct proportioning of the safety factors which are normally introduced in heating system design.

The job of the designer is to juggle a set of conditions to arrive at a desired end-point. These conditions are: (1) building heat loss, (2) heat dissipation of the heating units, (3) temperature drop in the system, (4) resistance in the system, and (5) pump capacity.

While the entire design procedure is predicated upon producing a certain indoor temperature at a condition of maximum cold, it is obvious that some of the design conditions are not constant but are variable. Inflexibility in the equipment used also means that compromise must be effected.

At the risk of seeming too elemental in this discussion, let us consider some of the conditions and how variations affect the ultimate design.

Temperature Drop in a Heating System

Forced hot water heating systems are designed to produce a flow rate which will permit the water to cool a predetermined number of degrees during its travel through the system.

There is considerable latitude in selecting a temperature drop. For small installations (as in residences and apartment buildings) 20 deg is commonly used. A drop of 30 deg is frequently the choice for larger systems, generally those having long distribution mains (such as large housing projects and industrial plants.) Or a combination may be used, with a 30 deg drop in the distribution mains and 20 deg in the circuits. Any of these values result in an economical design.

The temperature drop in any system is a variable condition. It will range from a minimum at low loads to a maximum when the outdoor temperature reaches the design temperature. Other factors which cause a departure from the design temperature drop are: (1) building heat loss less than estimated, (2) excessive safety factor in pipe sizes, and (3) pipe friction losses less than calculated.

Hence, in actual practice, a system

designed for a 20 deg drop may actually operate at drops from 15 deg upward. This deviation from design temperature is not important to satisfactory system operation, as will be shown later.

Friction Losses in the System

Proper selection of a pump begins with the calculation of friction loss in the system. There are three generally accepted methods — constant friction, additive friction and constant velocity.

The fact that pipes are made only in standard sizes materially affects design. Frequently, accurate design calls for in-between sizes, such as 1¾ in., but since these are not available, standard sizes must be used. Since it is a usual safety measure to employ an oversized rather than an undersized pipe, friction losses through the system will be less than calculated.

There is a second reason for reduction in friction losses. The design of a forced hot water system requires that the friction losses through the fittings, as well as through straight pipe, must be taken into account. The usual procedure is to add a percentage to the measured pipe length. This percentage varies considerably, depending upon the size of the installation, but experience indicates that the addition for the fitting is usually too large. As a result, the system actually has less friction loss than calculated.

A third reason is that pipe capacity tables which provide extremely high factors of safety, due to the possibility of fouling of the pipe, may be used. The pipe capacity tables for hot water heating systems which appear in the ASHVE Guide are much more accurate for this kind of work; even they have included factors of safety and take into account variations in internal diameter and roughness of surface.

Since pumps are selected on the basis of the *calculated* friction loss, it is obvious that oversized pipe and too great an allowance for friction through the fittings will result in a pump having more capacity than required.

Oversized Pump Generally Undesirable

The net results of an oversized pump are generally undesirable. In the first place, more money than necessary is expended for a larger unit. Second, the attempt to assure safety by oversizing frequently causes trouble because of the resulting increase in water velocity.

Water velocity should be limited to 4 fps in small pipes installed in dwelling units, as velocities in excess of this rate are likely to cause objectionable noises. Higher rates of flow are permissible in industrial installations where noise is not a factor.

For example, in a housing project in Boston, the tenants complained of noise in the heating system. Examination showed that a 7½ hp pump had been specified and installed. A pipe sizing check of the friction losses indicated that a 1½ hp pump would be amply large for the job.

In a Detroit apartment building, the pump installed was a 1½ hp unit. Here again, the tenants complained about the noise. Substituting a pump with a 1/3 hp motor remedied the trouble.

The heating system in a New York City housing project was unsatisfactory because of noise and faulty circulation. A re-check of the piping system showed that the 7½ hp pump was much too large for the installation. In this case the trouble was corrected by reducing the impeller size and substituting a 5 hp motor. Actually, a 1½ hp pump would have provided ample capacity for the job.

These examples indicate lack of understanding as to the acceptable extent of safety factors.

How The Pump Is Selected

In a closed fluid circuit, the head developed by the pump at any given flow is just equalled by the resistance in the system. In other words, the flow will vary from zero to a rate that produces a resistance just equal to the head developed by the pump at that flow.

This is better explained by Fig. 1. Assume a piping circuit where the resistance to flow is indicated by the curve labelled "System" and a pump having the characteristics indicated by the curve marked "Pump".

The vertical line "1" indicates a condition where the system resistance is less than the pump head. The distance between points *A* and *B* indicates the amount of head which is available but not used at this flow condition. The additional available head, or pressure, therefore causes the flow rate to increase, which in turn increases the resistance in the system.

Now consider a condition where the resistance in the system is greater than the pump head, as represented by vertical line "3". In this case, it is obvious that the pump cannot deliver the amount of water required because there is insufficient pressure to do so. Since less water is delivered, the resistance in the system becomes less. The ultimate flow rate will be at the point indicated by the vertical line "2", where a state of equilibrium is reached between pump head and system resistance.

Fig. 1 also shows the latitude afforded the designer in arriving at a system which is sound hydraulically and least expensive to install. For

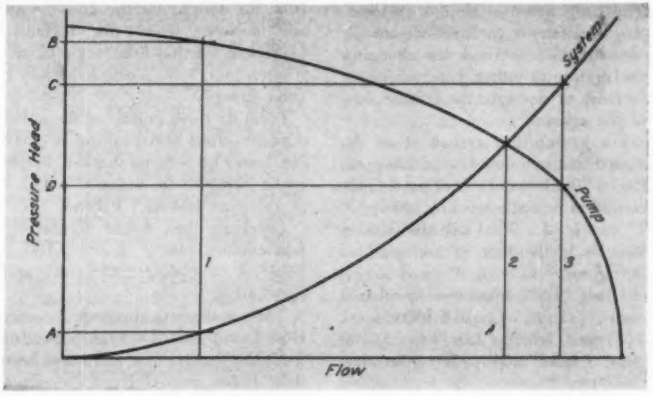


FIG. 1 — THE RELATION OF flow through the pump to flow through the system is shown on this chart

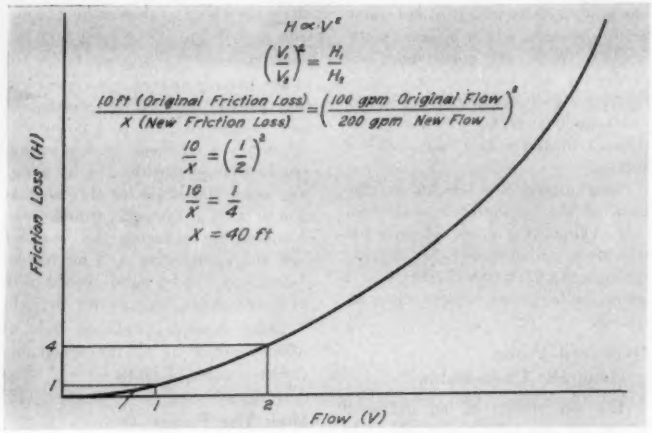


FIG. 2 — FLOW AND FRICTION loss are related according to this curve

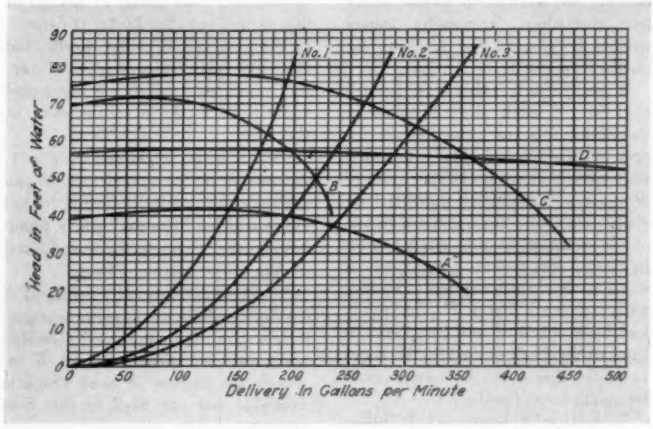


FIG. 3 — TYPICAL PUMP CAPACITY chart, values from which are used in the text to illustrate the importance of the right pump selection

example, if this chart represents the results of a trial calculation and the flow indicated by line "3" is not sufficient to carry the heating load, the designer has two options — either reduce system resistance by increasing pipe sizes, or use a larger pump, whichever is the most economical.

Relation Between Flow and Friction

The relationship which exists between flow and system resistance is that the head varies approximately as the square of the flow (this is the Fanning equation).

Fig. 2 illustrates this relationship of velocity to head. It also shows how the designer can produce any set of conditions desired by changing the piping or other components to increase or decrease the friction loss of the system.

For example, a system is so designed that at a flow rate of 100 gpm, the friction loss is 10 ft of head. This condition is represented by points "1-1" on Fig. 2. What will the friction loss be if the flow is increased to 200 gpm?

Using the equation mentioned above, [(10 ft, original friction loss) /(X, new friction loss)] = [(100 gpm, original flow)/(200 gpm, new flow)].[2]

Or, $10/X = (1/2)^2 = 1/4$, and $X = 40$ ft.

In other words, if in a given system the flow is doubled, the friction loss increases to four times the initial value. On Fig. 2, this is illustrated at points "2-4."

The above formula is helpful in determining a correct pump selection because it is seldom that a pump curve corresponds exactly with the hydraulic point desired. Failure to use it results in too frequently selecting a pump having head and capacity above the desired point. In many instances, this is both economically and mechanically unsound.

As an example, assume that a system is designed for 150 gpm at a 46 ft head. On Fig. 3 — a typical set of pump curves — the required water delivery line intersects the required pump head line at a point just above the curve of pump *A*. The question is: Should Pump *A* or the next larger Pump *B* be used?

One method of solving the problem is a cut and try procedure, using the square law previously mentioned and working with a known pump performance curve.

First determine what the actual flow would be using Pump *A*. Plot a curve on the pump chart which shows the heads at various rates of flow, both above and below the required 150 gpm. This curve is established by the following set of values:

Flow, gpm	Head, ft
150	46
75	11.5
100	20.5
125	32
175	63.7
200	82

The 150 gpm and 46 ft are known from the design, and the other figures are derived from the formula: [(original friction loss) / (unknown friction loss)] = [(original flow) / (new flow)].[2]

Locating these points on the pump capacity chart and plotting a curve No. 1 on Fig. 3 shows that the plotted curve intersects the curve of pump *A* at 140 gpm and 41.5 ft head.

Checking the plotted figures by mathematics, $46 / X = (150 / 140)^2$, $X = (140 / 150)^2 (46)$, and $X = 40$ ft.

The mathematical check is very close to the plotted values, indicating a slightly greater flow and lower head than those derived from the curve. This difference is insignificant.

[*Concluded on page 111*]

Contractor Working in Plant Has Landlord's Legal Duties

A RECENT LEGAL decision clarifies two important points for the heating, piping and air conditioning contractor. The first is that his responsibility for the area in which he works is the same as if he owned that portion of the premises. The second is that, if he should have occasion to sue for damages suffered through personal injury, he can figure his hourly wage in addition to his business loss if he has functioned as a workman on the job as well as contractor.

Reo Stadt & Brother (all names herein are disguised) was the electrical contractor doing a job for the Merrimel Candy Corp., while Tewbla Piping Co. was busy with piping work on the same premises. The two contractors were independent of each other. Workmen of both were using—as was customary—the rear door which opened onto a loading platform about 4 ft high, with steps at one end running down to the ground level.

Part of Tewbla's task was to install an underground pipe line parallel to the loading platform. For that purpose, Tewbla had a trench dug running the platform's length. When the work was finished, Tewbla had the trench re-filled to within 6 in. of the top, leaving it that way so it could be concreted over. Across the ditch was a plank walkway, which was used frequently by the workmen and by the candy company's employees.

Four or five days after the walkway was provided, Reo Stadt and his brother were carrying a very heavy electric motor into the building when the planks of the walkway separated, causing Reo's foot to slip between them and into the ditch. His left knee and leg being "seriously and permanently injured" as a result, he sued Tewbla and the candy company

for damages. The jury returned a verdict against Tewbla only, and the piping man appealed to the state supreme court from a judgment of some $6600.

Contractor Was "In Possession" of Area

The higher tribunal held that Tewbla as an independent contractor was *in possession* of the area necessarily occupied by his work and was therefore subject to the same liabilities as any *landlord*. Since Reo Stadt was a *business visitor*, Tewbla owed him a duty of due care to protect him from injury.

Tewbla, however, protested that the walkway was all right. From the evidence, he urged, the jury should not have found that he had "breached his duty" in construction or maintenance.

Unfortunately for Tewbla, the supreme court took a different view. Two witnesses had testified that although the walkway "appeared safe to the eye" the planks were not fastened together and when Stadt stepped on them they separated. Upon examination, after the accident, the planks themselves proved not broken or defective.

Approving the jury's finding that Tewbla had improperly constructed the walkway, the court referred to a case wherein a paving company was repairing a street and laid a temporary crosswalk of railroad ties. When a woman stepped from a trolley car onto the ties, they separated and she was injured. The superior court, in the cited decision, found that the evidence showed lack of due care in not laying the ties "so as to prevent spreading apart from the strain."

The supreme court in our subject case castigated Tewbla for his carelessness: He knew, or should have known, (a) that many candy employees as well as independent workmen would necessarily use the walkway daily; that (b) heavy loads would be carried over it, requiring strong construction; and that (c) persons carrying large, heavy objects "cannot exercise the same degree of care in placing their feet" as do persons unencumbered.

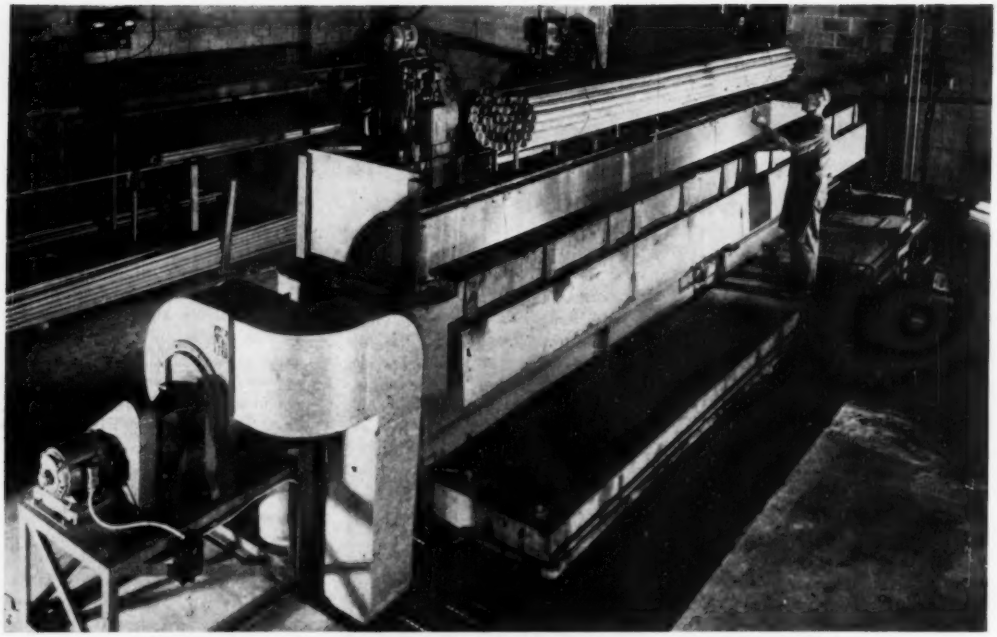
While the case was before the lower court, the jury had awarded Reo Stadt's widow (he having died meanwhile of natural causes) $10,147.48, including $5500 damages "to cover pain and suffering". In the lower court this award had been reduced by consent of the widow to $6,647.48.

Asking the supreme court for a new trial (which was refused), Tewbla revealed an instructive angle of the case in addition to its main significance. He protested that the hourly pay as a workman should not have been used to establish the loss sustained by Reo Stadt, a contractor. However, the record showed that Reo worked with his employees as an electrician.

"In computing the price of a job," said the court, "he would naturally include an item for his time, and in addition a profit for his business." The fact that his widow claimed only the hourly pay item "when she could also have shown the loss to the business as a result of his incapacity" was not deemed by the court as af-

[*Concluded on page 108*]

William Hurd Hillyer, author of this article, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., his work there gave him a practical legal background.



GENERAL AND LOCAL exhaust ventilation are the most important methods of controlling the health and fire hazards associated with the use of solvents. A large degreasing tank with slot type local exhaust ventilation is shown here. (Photo courtesy Detrex Corp.)

Using Solvents Safely

. . . . . depends on knowledge of their properties. Ventilation is the most important method of controlling the health and fire hazards

By Allen D. Brandt

Chief Industrial Hygiene Engineer
Bethlehem Steel Co.

SUBSTANCES WHICH FALL in the category of solvents, cleaners and thinners are numerous and the number is growing by leaps and bounds in the current organic chemistry era. The term "solvents" as employed herein includes those liquids which are used widely in industry generally for cleaning or degreasing and as thinners or diluents for paints, lacquers, varnishes and other finishing coats.

Primary attention here will be given to the health aspects of the problem rather than the fire hazard, but the latter will not be omitted or belittled. It is very important that this distinction be made because in many respects the approaches to the solution of a fire hazard run counter to those of a health hazard. Yet, if the difference is not recognized and appreciated, erroneous and dangerous conclusions will be deduced.

For example, a paint remover composed of chlorinated hydrocarbons (which have serious toxic possibilities) presents much less fire risk than one made up largely of ethyl acetate and acetone. On some paint removing operations, the use of the "health safe" ethyl acetate and acetone remover will present a greater risk to life and limb from fire or explosion than the chlorinated hydrocarbon remover will present to the health of the employees.

Both the health and fire risk aspects of the problem are important

and must be given due consideration in any worthwhile discussion of it.

One other point of misinterpretation or lack of knowledge which frequently leads to erroneous conclusions should be mentioned. This is the misconception of so many people in fire prevention work that if the atmospheric concentration of a flammable vapor is kept below the lower explosive limit (or 20 percent of it as is a common procedure) no health hazard exists. Nothing could be further from fact.

Gasoline is a relatively harmless solvent, its safe concentration being 500 ppm (parts of gasoline per million parts of air) as compared to 35 ppm for benzol, and it is an extremely flammable one. Yet 20 percent of its lower explosive limit is 0.26 percent or 2600 ppm, which is more than five times its safe limit from the health viewpoint. Consequently, it can be seen that the truth is the exact reverse; namely, if the atmospheric concentration of a volatile solvent is kept below the safe level from the health standpoint, it will be much below the lower explosive limit.

The safe use of solvents requires that a suitable one be chosen and that it be used safely. Let us now consider these two different points.

Selecting the Solvent

The selection of a solvent is obviously governed primarily by the use to which it is to be put; it must be a substance which will do the job. Yet, the number of solvents available today is so large that with but rare exceptions there are several which can be used satisfactorily from the operational standpoint. The job then is to decide which one of those known to be satisfactory for the job in question will present the least health hazard or be easiest to control. Since the health hazard is a function of the absolute toxicity, the volatility and the quantity required, it follows that the selection is based on these factors. This unfortunately is not a clear-cut procedure because the foregoing factors are influenced by a number of other variables — especially the temperature and nature of operation.

With information on the toxicity and volatility of solvents (see page 109) and an appreciation of the influence of other circumstances associated with the job, it is possible to make a selection of the safest solvent. It must be emphasized, however, that picking the best solvent is not a clear-cut procedure; the conditions of operation also must be taken into consideration. For example, a solvent having a maximum allowable concentration of 500 parts per million (ppm) may be selected in preference to one having a safe level of 200 ppm on the basis of the lower toxicity, but the solvent properties may be so inferior that three times as much is needed to do a satisfactory cleaning job. Hence, if the operation is such that complete evaporation of the used solvent takes place in the room where the cleaning is done, the vapor concentration in the air will be about three times as high with the safer solvent as with the other and the net effect is that a greater health hazard exists than if the more dangerous solvent had been selected.

Such conditions are uncommon, of course, but it is unwise to make a decision without considering all factors which influence the final result.

Non-Descriptive Names Complicate Problem

Since many of the solvents in use in industry today (and most of the new ones) are not single substances but proprietary compounds, the problem of selection is complicated even further. Solvents of this kind are usually marketed under non-descriptive trade names which frequently are coined primarily to be "catchy." Large and primary manufacturers will usually give information on the ingredients in such products if requested to do so by responsible persons. The small manufacturer or jobber, however, frequently will not supply such information, justifying his stand on the basis that (1) it is this secret that keeps him in business, (2) the material contains a highly unusual and effective ingredient which only his product contains and which in turn is responsible for the superiority of his product, (3) it is the unusual proportion of the ingredients that makes his product unlike others having similar ingredients, and (4) various and sundry other excuses intended primarily (I believe) to mystify the person to whom the letter is addressed. All too frequently the product is alleged to be absolutely non-toxic.

While statements of this kind usually stem from lack of knowledge rather than from dishonesty, the net effect is the same insofar as industrial hygiene is concerned. Since control or preventive measures, whether they be ventilation or respirators, involve the expenditure of time and money, it is good business to do no more than necessary. To know how much is necessary requires accurate knowledge as to the composition of the solvent being used. Obviously then, the preventive measures must either be overdone or a calculated risk must be assumed when using a product of unknown composition. Calculated risks are imperative on the battlefield but neither such risk nor unnecessary precautions have any place in industry.

It follows then that only those solvents whose composition is known should be employed. This means that either industry will have to analyze certain proprietary compounds that are found by experiment to be superior on cleaning or painting jobs or the vendor will have to supply information as to the ingredients if the new solvents are to be used with safety. I believe that if industry were to present a united front to the vendors on this issue, the required information on composition of trade-name solvents would be forthcoming promptly and without any ill feeling whatsoever.

From the viewpoint of the health aspects, solvents, cleaners and thinners may be classified by composition into four large groups — aromatics; halogenated hydrocarbons; alcohols, esters, ethers and ketones; and paraffins and naphthenes. The first group, aromatics, includes such materials as benzene, toluene and xylene which are very toxic — maximum allowable concentrations range from about 35 to 200 ppm. Halogenated hydrocarbons also are very toxic — the maximum allowable concentration limits being the same as for aromatics. Examples are carbon tetrachloride, trichloroethylene and dichlorobenzene. The alcohols, esters, ethers and ketones generally encountered in solvents are less toxic than the preceding groups and have maximum allowable concentrations ranging from about 200 to 500 ppm. Examples are acetone, methyl ethyl ketone, the alcohols and the acetates.

The last group, paraffins and naphthenes, are even less toxic. The maximum allowable concentrations for those commonly encountered range from about 500 to 1000 ppm. Examples include gasoline and petroleum naphtha.

Ventilation Most Important Control

We come now to the second step — using the solvent safely. As with any atmospheric contaminant, there are several methods that may be followed to control the health hazard associated with the use of any solvent. Much has been written on this subject and volumes more might be without becoming redundant.

The most important methods of controlling the health hazard and the fire hazard associated with the use of solvents are general and local exhaust ventilation. Of these, the former is more readily applicable as a rule than is the latter.

General ventilation is effective in preventing the creation of unsafe solvent vapor concentrations in the atmosphere by diluting the vapors or the grossly contaminated air with sufficient clean air to render the air breathed by workers harmless. This control procedure is especially useful against vapors because of their relatively low toxicity on a weight basis as compared with dusts and fumes. What is more, the necessary general ventilation rate may be computed with considerable accuracy since a gram-molecular weight of any solvent will produce 0.96 cu ft of vapor when in the gaseous state. Hence, if the solvent and its consumption rate are known, it is easy to determine what is the required minimum general ventilation rate to prevent excessive contamination of the general air. This calculation has been simplified into the following formula:

$$Q = (0.81 \times 10^6 \times S)/(XY)$$

where Q = ventilation rate, cfm; S = solvent consumption rate, lb per 8 hr day; X = molecular weight of the solvent; Y = maximum allowable concentration of the solvent, ppm.

The required minimum dilution or general ventilation rate for a number of solvent liquids is given in the table on page 109. As indicated in the table, these rates are based on a solvent consumption rate of 1 lb per minute. Hence, the ventilation rate required for any operation at which one of the solvents listed in the table is used can be estimated rapidly by multiplying the rate given in the table by the actual consumption rate in pounds per minute. Information on the maximum rate of solvent consumption usually can be estimated from previous experience with similar solvents.

The high ventilation rate for some of the solvents given in the table should be noted as compared to the low rates for others. Obviously, if a selection had to be made between solvents of these two groups, one of the latter would be chosen.

LAW AND YOUR PROFITS —

[*Concluded from page* 105]

fording Tewbla any cause to complain. The higher tribunal denied all of the piping company's contentions — including legalistic grounds of a "molded" verdict — and affirmed the anti-Tewbla judgment.

Why Piping Company Suffered the Loss

Tewbla suffered this substantial loss for obvious reasons. He failed to consider that within his working area he functioned as a *landlord*, with all attendant duties and liabilities. Among the most exacting of these duties was to safeguard employees and independent workers on the premises while they were in the area for which he was responsible.

He carelessly provided a walkway by laying down loose planks in such manner as might have afforded reasonable safety to persons crossing without burdens but presenting a real hazard to workmen encumbered with heavy objects. He seemingly failed to realize that the walkway should have been constructed and maintained with *greater* care than if it had been in an area frequented by the general public.

Helpful Hint to Smaller Contractor

Viewed from the standpoint of the injured party, this case affords a helpful hint to the smaller contractor, who might occupy that role. If he customarily works on the job with his men, he can figure his hourly pay at regular wages in addition to his loss of profit as a business man.

[Note: While this discussion applies to an actual case, it should be remembered that legal rules vary in different states.]

ROOM AND UNIT TO COOL IT MUST "MATCH"

THE VARIATION in the actual size of of a room that a specific room air conditioner will properly cool will vary as much as 700 percent, depending on eight factors in addition to room size, occupancy and climate.

Any reputable make of ¾ hp room air conditioner may be suitable for a room having a floor area of anywhere from 70 sq ft to 500 sq ft, according to Herbert L. Laube, of Remington Corp., chairman of the room air conditioner section of the Air Conditioning & Refrigerating Machinery Association, depending on the following:

1) The differences in room location. In this latitude, a room on the north side of a building can be adequately cooled by a much smaller unit than a room on the southwest corner, where the sun heat is felt most severely.

2) The area of the room's windows.

3) The extent of outside shade from trees, other buildings, etc.

4) The construction of the building itself — whether it is an uninsulated frame house, an insulated structure, or has heavy masonry walls.

5) The ceiling height — whether it is 7½ ft or possibly 12 ft.

6) The construction and location of the ceiling: Is it insulated, is it uninsulated but under occupied space, or is it uninsulated and adjacent to a hot roof or attic?

7) Is the room on the ground floor or is it over occupied space?

8) Is the unit for daytime use or just for night use, as in a bedroom?

"The room air conditioner is totally unlike any major electrical appliance," according to Mr. Laube. "It is useless unless it is used in the proper environment. Unless the room to be cooled and the unit to cool it are 'matched', the results will not be good. The room air conditioner is nothing more than a mechanism for pumping heat out of the room. Unless the unit does this, it cannot possibly give satisfaction."

The ACRMA has developed a simplified estimating form now used by many room air conditioner manufacturers. In a matter of 10 or 15 minutes after a room has been surveyed, what size room air conditioner is needed for the particular space to be cooled can be determined, he said.

DATA SHEET

Relative Volatility, Maximum Allowable Concentrations, and Ventilation Rates for Common Solvents

[See preceding article by Allen D. Brandt]

MAXIMUM ALLOWABLE CONCENTRATION (approximate) of some common solvents

Substance	Maximum allowable concentration, Ppm*
Acetone	500
Amyl Acetate	200
Amyl Alcohol	100
Benzene (benzol)	35
Butyl acetate	200
Butyl alcohol	100
Carbon disulfide	20
Carbon tetrachloride	50
Dichlorethylene	200
Ethyl acetate	400
Ethyl alcohol	1000
Ethylene dichloride	100
Gasolene (benzine)	500
Hexanone	200
Methyl acetate	200
Methyl alcohol	200
Naphtha (petroleum)	1000
Propyl acetate	200
Tetrachloroethane	10
Tetrachoroethylene (perchloroethylene)	100
Toluene (toluol)	200
Trichloroethylene	100
Turpentine	100
Xylene (xylol)	200

*On basis of 8 hr daily exposure — in parts of substance per million parts of air by volume.

SOME COMMON SOLVENTS and their relative volatility

(Volatility increases as the volatility index increases)

Substance	Volatility index
Acetone	21
Amyl acetate	4
Amyl alcohol	2
Benzene (benzol)	13
Butyl acetate	7
Butyl alcohol	9
Carbon disulfide	23
Carbon tetrachloride	16
Chloroform	17
Dichloroethylene	22
Ethyl acetate	15
Ethyl alcohol	14
Ethylene dichloride	12
Ethyl ether	24
Methyl acetate	20
Methyl alcohol	18
Methyl ethyl ether	25
Naphtha (petroleum)	19
Propyl acetate	10
Tetrachloroethane	5
Tetrachloroethylene (perchloroethylene)	6
Toluene (toluol)	8
Trichloroethylene	11
Turpentine	1
Xylene (xylol)	5

VENTILATION RATE design data for a number of common solvents

Substance	Molecular weight	Specific gravity	Required minimum dilution rate, cfm per lb per min
Acetone	58	0.79	12,400
Acetylene tetrachloride	168	1.58	231,600
Acrylonitrile	53	0.80	366,000
Amyl acetate	130	0.87	16,900
Amyl alcohol	88	0.82	88,000
Benzol	78	0.88	142,000
Butanone	72	0.81	25,200
Butyl acetate	116	0.88	16,700
Butyl alcohol	74	0.81	49,000
Butyl cellosolve	118	0.90	16,400
Carbon disulfide	76	1.26	255,000
Carbon tetrachloride	153	1.58	25,300
Cellosolve	90	0.93	21,500
Cellosolve acetate	132	0.97	29,400
Chloroform	119	1.50	32,500
Cyclohexanol	100	0.96	32,200
Cyclohexanone	98	0.95	39,600
Dichlorobenzene	147	1.32	35,200
Dichloroethylene	97	1.25	80,200
Dichloroethyl ether	143	1.22	181,200
Dioxane	88	1.03	8,800
Ethyl acetate	88	0.89	11,000
Ethyl alcohol	46	0.81	8,300
Ethylene dichloride	99	1.26	39,300
Ethyl ether	74	0.72	10,500
Hexanone	100	0.80	19,400
Methyl acetate	74	0.94	26,200
Methyl alcohol	32	0.79	60,600
Methyl cellosolve	76	0.96	51,200
Monochlorobenzene	113	1.11	46,100
Naphtha (petroleum)	110	0.75	3,500
Perchloroethylene	166	1.62	12,500
Propyl acetate	102	0.87	19,000
Propyl alcohol	60	0.79	16,200
Solvesso	125	0.80	15,500
Stoddard solvent	130	0.80	3,000
Styrene monomer	104	0.91	9,300
Toluol	92	0.86	21,100
Trichloroethylene	131	1.48	29,600
Turpentine	136	0.87	28,600
Xylol	106	0.88	18,400

SAM LEWIS' PAGE

Converting Heating To Low Pressure Steam

(including a bit of "history")

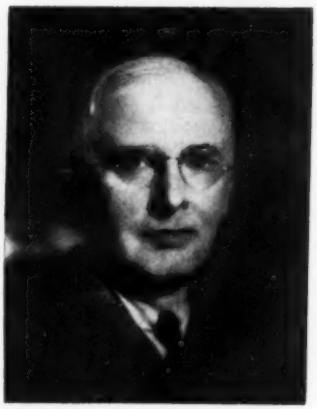
AROUND 50 YEARS or so ago, the few public service electric companies were furnishing direct current. This meant heavy transmission losses, necessity for big wires and so much investment that many industrial plants, office buildings and hotels generated their own electric power almost as a matter of course. Steam boilers operating at what was called high pressure — 100 to 150 lb — supplied steam to reciprocating engines driving ponderous dynamos that, by aid of their built-in commutators, could send forth direct current electric energy.

The steam used in such engines must be diluted with lubricating oil or the sliding pistons could not slide. The exhaust steam from the engines retained nearly all of the heat that had been absorbed when the original water was evaporated, and could be condensed in radiators and convectors for heating and ventilating the rooms in the building. The heat also could be conserved for warming water for lavatories, baths and for manufacturing processes. The lubricating oil, however, had to be removed from the exhaust steam or eventually it would clog the heating pipes.

Returning Condensate To the Boiler

After heating the building, the water condensed from the exhaust steam still was hot, and could be returned hot to the boilers — conserving still more fuel. This hot water also contained less scale-forming matter than the usual cold new water.

The greater the difference in pressure and temperature between the steam that enters the engine and that which is exhausted from the engine, the more power will the engine deliver. It follows that if a pump could withdraw rapidly the condensed hot water from the heating system, the pressure of the exhaust steam leaving the engine could be reduced, and the more electricity could be sent out by the dynamo. However, the pump suction could only be expected to reduce the air and vapor pressure above the water in the condensate pipes, and thus permit atmospheric pressure to aid in forcing back the hot condensed water from the exhaust steam. It was desirable to separate the steam from the warm water, so that the pump could handle water only, and not be jumping and jerking and racing whenever the relatively solid liquid water was superseded by the steam — which is an elastic, flexible gas.



SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems. In answer to a request from a reader, he writes here on the conversion of high pressure steam heating installations to low pressure operation

A gadget called a trap was needed. The early trap comprised a float that would rise when lifted by water to open a valve, and that would fall to close the valve against passage of steam as soon as the sustaining water no longer was present. These float traps still are employed, of course, on the condensate outlets of steam heating vessels, but share the duty to a great extent with a later trap that responds not only to water that is relatively cool, but also is sensitive to the temperature of the water or steam that comes to its thermostatic element.

Alternating Current Replaces Direct

The public utility people knew enough about electricity to realize that the basic electric energy generated by the dynamo was of the alternating type. They learned to employ alternating current for illumination and for motors without the service of the old, heavy, costly and troublesome commutators. Alternating current can be handled safely at thousands of volts pressure, for distant transmission through outdoor wires much smaller and less costly than those required for direct current. They learned to increase the boiler pressure and the heat in the steam to such an extent that the pipes in many power plants show red in the dark, and they substituted continuously whirling turbines for the sliding reciprocating pistons. They learned that greater energy could be developed from fuel if the exhaust steam from the turbine was cooled to a pressure far below atmospheric.

Converting To Low Pressure Operation

The economies in electric generation made it necessary for many of the large hotels, office buildings and industrial plants to abandon the old direct current generators and engines. They could purchase the energy much more economically than they could operate their own systems. In some

cases, the space saved by removal of the old engines and dynamos from basements was thankfully received, but the exhaust steam and the boilers still had to be retained for domestic water service and for heating and ventilating.

In most cases, the building may continue to operate the original boilers. Frequently, it is practicable to reduce the steam pressure in the boilers to less than 15 lb. Depending to some extent on the type of boiler, it may be desirable to weld on to the steam drum a larger outlet nozzle so as to compensate for the greater volume of steam carrying the same heat at low pressure. Larger boiler outlets militate against the steam carrying along out of the boiler an excessive amount of hot water that does not have time to separate from the steam. Often, it is desirable to substitute electric condensate pumps for the old steam driven pumps. However, I have personally designed and carried through several of these conversions from high pressure to low pressure, merely by installing new and larger safety valves on the boilers and by removing the old steam separators, oil separators, back pressure valves, reducing valves, etc.

Get Rid of Old, Unused Equipment

We have also simplified the often tortuous travel of the steam from the boilers to the heating systems.

Experience with steam plants in many large institutions emphasizes one cardinal principle, which is to insist on removal of all redundant pipes, fittings and valves. If left in place, these old apparatuses merely confuse the operator; many waste heat unnecessarily; others cause objectionable overheating of adjacent rooms (as in one large hospital); and sometimes the old equipment may be sold at better-than-scrap prices.

More Pounds Removed Than Retained

I wish to make a loud protest against boiler and engine rooms and pipe shafts cluttered with obsolete pipes and valves. I proved to the owner of a very large hotel, inspected last week, that more pounds of iron and steel could be removed from the boiler and engine rooms than the pounds that should be retained to perform all necessary duties.

DON'T OVERSIZE PUMPS —

[*Concluded from page 104*]

One hundred and forty gpm is 93.5 percent of the desired quantity, which at first glance would seem to fall short of design requirements. Further calculation, however, shows that if the system was designed on a 20 deg temperature drop, this reduction in flow would result in an actual drop of 21.4 deg. The equation is: $(150 / 140) = X / 20$, $X = (1.07)\ (20)$ and $X = 21.4$.

This lower flow would require a rise of 0.7 deg in the boiler water temperature and an additional drop of 0.7 deg would be required in the return. These small and obviously insignificant differences indicate that the pump having characteristics lower than the design point is the logical selection.

Now, as a matter of interest, check the performance of the larger Pump *B*. The plotted curve intersects the pump curve at a point where 175 gpm will be delivered at a head of 62 ft.

The mathematical check closely confirms these values: $X / 46 = (175/150)^2$, and $X = 62.5$ ft approximately.

This is a flow approximately 17 percent greater than required. Checking to see how the increase will affect temperature drop, $(150/175) = X/20$, $X = (0.857)\ (20)$, and $X = 17.1$ deg temperature drop.

While this change in design temperature drop is again too small to be significant, there is no point in selecting a larger pump when a smaller one will do the job.

In case it is thought that the selection of Pump *A* cut things too fine for safety, consider the safety factors which are inherently or deliberately included in the design. One such inherent factor is in the carrying capacities assigned to pipe. Some pipe capacity tables provide such high factors of safety that the calculated friction loss at design flow may be too high by as much as 50 percent.

Second, the allowance made for the resistance of the fittings is usually on the generous side. If accuracy is desired, a tedious series of calculations must be made, but, as stated earlier, the designer usually bypasses this work by adding a percentage to the measured pipe length. Generally speaking, this method is satisfactory.

The close selection of a pump is, therefore, justified by both the conservative values given in pipe capacity tables and by the practice of making large friction allowances for the fittings.

There are many types of systems, however, where the addition of a percentage figure to the measured pipe length is not acceptable. Any large system should be re-checked after the original designing to be sure that the friction losses are not materially less than the design figures would indicate.

Dangerous To Add Arbitrarily to Head

Another practice is to arbitrarily add to the calculated head when selecting the pump — sometimes as much as 50 percent. While this is considered to be a safety measure, it may have some nasty repercussions.

To illustrate, consider what would happen to pump performance if the calculated head were arbitrarily increased by 50 percent, raising it from 46 ft to 69 ft.

Pump *C*, which the pump chart shows as delivering 150 gpm at a 78 ft head, would normally be selected. The actual delivery, as shown by the curve No. 1 on Fig. 3, would be 195 gpm at a 76 ft head.

This in itself is not too serious a case of over-pumping, but consider now the effects if the original calculation of a 46 ft head were 100 percent high, the actual head being 23 ft. This is not an absurd assumption, as too liberal allowances for friction losses have frequently caused such errors.

Plotting curve No. 2 on Fig. 3 on the basis of a 23 ft head shows that Pump *C* would actually deliver 265 gpm at a 70 ft head, or 77 percent more water than required. This flow rate might produce excessive velocities and noise in the system.

To carry this process to extreme limits, had the original calculation of friction loss been so far off as to call for 150 gpm at a 15 ft head, it is evident from curve No. 3 that water delivery would be so far in excess of the desired quantity that any of the pumps shown on the chart would be much too large.

The foregoing discussion illustrates what happens in a system when the head and capacity of a pump is not matched to the piping circuit.

Radiant Heating and Wood Floors; Balancing Jobs

SOME INTERESTING questions on the use of radiant heating with wood floors have been discussed in these columns. One of them concerns the allowable output in Btu per hr per sq ft of floor and the resulting surface temperatures, which is one of the most controversial phases of radiant heating.

Despite numerous research projects, several well-prepared handbooks, and many articles by heating authorities, it is my opinion that there is yet no infallible nor even reliable chart, formula, or mathematical procedure by which floor surface temperature can be accurately predicted. The combining of research, theory and practice has produced some useful limits, but to calculate surface temperature over the complete range of output from 0 to 100 Btu per hr per sq ft has so far been an impossibility.

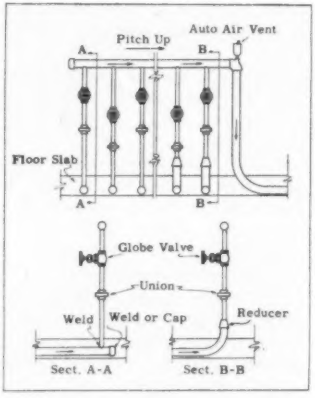
In an article by me in the January 1951 HPAC, I reported the general design and installation procedures followed on a wood floor job where piping was placed in the joist spaces above an insulated ceiling. It was stated that this particular job, together with several others, had indicated that the upper output limit for such installations was in the 40-60 Btu per hr per sq ft range. I have been asked specifically what surface temperatures would exist under these conditions. Only one investigation with instruments was made of the installation and the results are briefly tabulated below:

Room	Heat loss, Btu per hr per sq ft*	Average floor temperature, F
A	27	80
B	15	80
C	33	78
D	23	77
E	33	80

*Outside air temperature 35 F, wind velocity 15-20 mph.

At the time of the tests the ceiling surface temperature was 70 F, average unheated wall surface temperature 64 F, average single glass temperature 49 F, water temperature 140 F, and room air temperature 76 F. All of the floors were double wood except *C* and *E*, which were subfloor with asphalt tile or linoleum.

From the aforesaid table it can be seen that any attempt to correlate output with surface temperature would lead to confusion. Furthermore, while no tests were made at the time, the owner reported complete comfort with −12 F outside and floor temperatures which were "not even warm to the touch". The last statement is purely an expression of opinion, but is at least important from the standpoint of the owner's comfort and satisfaction. The boiler water temperature was raised to 200 F to provide adequate heat under the −12 F conditions and the heat loss figures in the aforesaid table would have to be slightly more than doubled. Personally, I consider 200 F too high for water in piping which may be in contact with wood flooring, but when the piping is strapped to the bottom of 8 in. joists no difficulty except slight separation of the flooring strips was noticed.



BALANCING MANIFOLD used on radiant heating installations. The sections show two methods of extending the coils above floor level

The question of using radiant heating with wood floors has also been brought up. I should like to go on record as follows:

1) Where wood flooring is desired, I prefer to see the piping in concrete rather than an air space. However, particularly with *basementless* construction, the installation and operation procedures are extremely important if damage to the flooring on concrete is to be avoided.

2) Where the piping must be placed in air (and such cases are possible) the output should be limited to approximately 40 Btu per hr per sq ft of floor, although the exact limit will vary in some cases.

Balancing the Pipe Circuits

Another question concerned practical methods for balancing pipe circuits in radiant heating systems. In most of the earlier radiant heating systems, a balancing valve for each coil was located in a floor box formed into the floor. While this procedure normally was adequate to accomplish balancing, the following objections arose over a period of time:

1) Floor boxes unsightly.

2) The small space usually available does not permit easy repair or replacement of valves.

3) Floor boxes may not provide adequate venting facilities.

4) Floor boxes limit arrangement possibilities for equipment, fixed furniture, etc.

5) Scattered location of balancing valves complicates balancing operation, particularly in buildings such as hospitals, etc.

6) Floor boxes may not be permitted in mental institutions, jails, etc. and may not be desirable in schools, etc.

In an attempt to eliminate these objections, engineers and contractors are making use of balancing manifolds, an example of which is illustrated in the sketch. These mani-

folds may be located in closets, utility rooms, pipe spaces, etc. and while at first glance they may appear to require considerable space, manifolds have been easily installed with an overall height of 18 in. and risers spaced on 4 in. centers. The major part of the fabrication is completed in the shop and connections above floor level may be threaded or welded. The vertical risers are normally sized in the same manner as risers to convectors or radiators — on the basis of the calculated flow through the radiant heating coil. Since the heating coil is usually larger than necessary from a hydraulic standpoint, the riser may be smaller than the coil piping, although ½ in. is considered a practical minimum. By sizing the risers in this manner, the coils are more self-balancing, a finer degree of balancing by valve adjustment is made possible by the higher velocity through the small risers, and the cost of valves, fittings, etc. is substantially reduced.

The sketch illustrates two methods of extending the coils above floor level. Section *A-A* provides for drilling the coils for welding in the smaller risers and capping the coil end; Section *B-B* provides for bending the coil ends up through 90 deg and the use of a welding or threaded reducer for connecting to the smaller riser. The union is of course to facilitate installation and replacement. A globe valve is indicated but other types may be used at the discretion of the engineer or contractor. The manifold header is simply a receiver or plenum chamber and may be sized the same as the return main or a size larger if necessary to facilitate welding in the risers. The header should be pitched up slightly to an air vent at the return main end of the header. A special air vent fitting is shown on the sketch, but other arrangements may be used if they provide adequate venting.

The balancing manifold — if properly vented — should eliminate the need for any other vents on the individual coils. It is still considered good practice to vent risers and points where piping elevation changes. The manifolding arrangement also has been used to clean out individual coils after fabrication and testing before the concrete is poured. Cleaning out, which may be desirable after the system has been in operation, is also simplified in most cases by disassembling the union and attaching a hose fitting to permit running a flexible hose to the nearest drain. The balancing manifold will have its greatest use in radiant heating systems but is equally adaptable to snow melting systems, industrial piping, or other systems where regulation of flow through a number of parallel piping circuits is necessary. —Paul S. Park, Jr.

Wants Labor Data on Equipment Installation

If you don't have the answer to one of your problems, chances are someone else does — or can be helpful on part of it. That's the purpose of this "idea exchange" in each issue, where questions on heating, piping and air conditioning are asked and answered.

You are invited to contribute a question for publication, or an answer to a published question. . . . . Please address your reply to the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

Here is a question asked by a consulting engineer. Can you help him out?

"We would appreciate knowing if there is any published labor data (in any form) on the installation of heating, piping, and air conditioning equipment. Suggestions from readers on where to refer to such figures would be most helpful. Perhaps some of HPAC's readers have data along these lines that they might be willing to make available for publication."

OPERATING BOILER WITHOUT SMOKE

I am most interested in the chief engineer's query on operating a boiler without smoking, as given in the Question of the Month in April.

No mention was made of the gas analysis. Therefore I assume a CO_2 recorder is not used. I would suggest that the trouble is caused by insufficient air, resulting in poor combustion. This produces particles of unburned carbon in the flue gas instead of CO_2.

I imagine that when the stoker is idling, the primary air fan is stopped Therefore, little or no air is being drawn into the bottom of the tuyere. If combustion is to be maintained, therefore, secondary air must be allowed to travel over the top of the fuel bed.

If one of the firing doors is opened a little it should improve the condition.

If not, I would like to add, that if the height of the chimney is insufficient, insufficient draft will be created, causing incomplete combustion.—K. W. Jones.

Ultramodern Foundry Completed

The metallurgy building — first completed structure in the General Motors Technical Center near Detroit — is 320 ft long, 110 ft wide and 36 ft high. Laboratory and office rooms, ranged along a gallery on either side of the foundry bay, are air conditioned with a high velocity system. Atmosphere of the foundry area is controlled with a special ventilation system exhausting through the roof on either side of the monitor. The entire structure can be purged of air within three or four minutes. Three main supply units filter the air and maintain a steady, automatically controlled balance between exhaust and new air volume. As with all other buildings at the Center, maximum flexibility prevails throughout. For instance, the roof flanking the monitor top is a so-called "soft roof." Entire sections can be removed easily or cut to make way for additional ducts, if necessary, or seal over the areas where ducts are removed. Likewise, grating of the 5 ft balcony overhang can be easily removed anywhere over the foundry to accommodate piping or ducts.

ANYTHING CAN HAPPEN

More Hot Water for Washing Steel Drums

• *Almost anything can happen when you're in the engineering or contracting (or sales) ends of the heating, piping and air conditioning industry. The objective of this more-or-less regular editorial feature in HPAC is to discuss the daily, practical problems that need solving — and the ways to solve them ..... One of HPAC's readers answers this month a question he was asked by a soft drink manufacturer about how to increase the flow and pressure of hot water for washing steel drums*

A SOFT DRINK manufacturer in our city phoned the other day. At this plant, they have a problem of washing the steel drums used for shipping their product. Being convinced that an increased hot water flow would answer the problem, they called to request that we recommend a pump of greater capacity than the present unit.

Like so many problems involving increased flow requirements, the answer isn't always simple. Also, as is often the case, it is difficult to determine all of the conditions. Our friends suggested buying a pump to probably double the flow, and they assured us that this would entirely satisfy their needs. However — to be certain — they became convinced that a few test runs might prove worth the time needed.

Barrels are washed by racking over a series of spray nozzles which operate for three minutes. This time period was considered sufficient with 200 F water flowing at a rate of 35 gal per barrel during the three minute period. Twenty barrels are washed per operation. Thus, it is evident a flow of 700 gal per three minutes, or a pumping capacity of 233 gpm, is required. Of course (although the customer hadn't given this factor much thought), before suggesting a pump it was necessary to know also the discharge head required. Fortunately, a gage had been installed at the pump discharge and also one at the city supply line as it entered the pump. In addition, a gage was located in the piping header preceding the nozzles.

By slightly re-arranging some of the nozzles, it was possible to fill a few of the barrels at the wash rack during a normal cycle. Having weighed the barrels before and after the wash period, it was determined that the flow rate was 400 gal in three minutes for the 20 barrels, or 20 gal per barrel (133 gpm).

The gage readings indicated that the city pressure was 30 lb. The discharge pressure at the pump was 54 lb and the pressure reading at the nozzle header showed 24 lb.

The plant engineer pointed out that the new flow rate of 35 gpm was determined at another of their plants, where the washing operation was a success. He also explained that at the second plant a pressure of 60 lb was available at the nozzle header. Therefore, he told us simply to specify a pump to give these conditions.

Must Remember Ratio of Flow to Head

Actually, the result amazed our friend, who hadn't considered the important ratio of flow to head when either is changed. The pressure drop through a system increases as the square of the ratio of the flow increase.

The original flow was 133 gpm and the contemplated flow 233 gpm. The flow increase ratio is therefore 1.75. As a result, the pressure drop could be expected to increase at the rate of 1.75^2 or about 3.

The pressure drop through the system at 133 gpm was 30 lb. At 233 gpm we can expect a pressure drop of 30 lb $\times$ 3 or 90 lb. City pressure is available at 30 lb and the customer wants 60 lb at the nozzle header. Adding the piping pressure drop of 90 lb, the required pressure at the nozzle header of 60 lb and deducting the available 30 lb, we have determined a pump discharge pressure required of 120 lb. At a flow rate of 233 gpm, the pump needed must be driven by a 25 hp motor.

The customer was amazed. He had been operating with a 3 hp pump delivering 133 gpm at a head of 24 lb. Now, simply by increasing the flow 133 to 233 gpm and increasing the pressure requirements slightly (in his opinion), a 25 hp pump is indicated.

Before installing the new pump, we suggested disconnecting the old pump and measuring the free flow from the city supply at the pump location. It was necessary to know, of course, that 233 gpm would be available at the new pump.

Heating the Increased Water Quantity

Having a pump size recommendation, our friend thought he was rid of us. But, of course, we remembered that the water needed heating to 200 F and although the heater capacity had been sufficient at the original flow of 133 gpm, we questioned if it would suffice at the new flow of 233 gpm.

Fig. 1 indicates the original water heater hook-up. Operating with this arrangement at the 133 gpm flow had been satisfactory, although there was some indication that the water temperature dropped slightly toward the end of the three minute cycle. On checking with the heater manufacturer, we found its capacity to be 8400 gph, or the equivalent of 140 gpm water heated from 40 to 200 F when steam was available at the 10 lb pressure the plant had been using.

The piping hook-up would indicate a flow of city water directly through the tank and to the building. Actually, during the draw the heater would contribute very little to increasing the water temperature going to the wash rack. Practically all heating was done during the "off" period of 10 minutes which took place between draws.

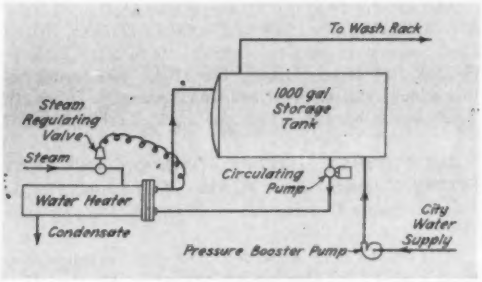


FIG. 1 — IN ORIGINAL WATER HEATER hook-up, practically all heating was done during the "off" period between draws

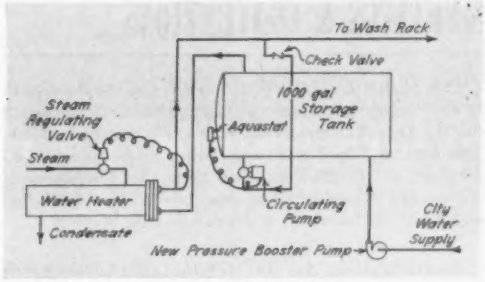


FIG. 2 — PIPING CHANGE suggested between heater and tank eliminates risk of short circuiting through the tank

Considering the new demand of 233 gpm, it was determined the temperature of the 1000 gal tank could drop to approximately 100 F at the end of the three minute draw of 700 gal. This was based on the assumption that the tank had been completely heated to 200 F before the draw began.

The heater manufacturer informed us the capacity of the unit from 100 to 200 F is 14,000 gph when provided with steam at 25 lb (which is available). Therefore, we suggested the piping change between the tank and heater shown in Fig. 2. This new arrangement eliminates the risk of short circuiting through the tank and assures a constant 200 F outlet temperature. In the old piping hook-up, the tank could become a mixing chamber wherein the entering cold water could easily mix with the stored hot water and as a result drop the outlet water temperature toward the end of the draw. The new arrangement, by causing the water to pass through the heater before going to the wash rack, assures further heating if necessary. Even if the tank temperature dropped to 100 F, the heater could furnish water up to a rate of 14,000 gph or 233 gpm at 200 F.

Maybe Too Ambitious a Cure?

By making the suggested changes and providing a new pump, the requirements of the problem could be met. However, as is often the case, problems of this kind sometimes result in too ambitious a cure. It might be questioned whether 60 lb at the nozzle header is actually needed. To get the 60 lb it is necessary for the pump to develop about 120 lb. This is in addition to the 30 lb city pressure and indicates a total pressure of 150 lb at the pump discharge. Probably the piping system — including the tank and valves — is designed for a 125 lb working pressure.

We therefore suggested to the plant that such a plan would not be good practice. Although we were convinced the 60 lb pressure requirement was too high, the customer disagreed. We suggested, therefore, that he buy a pump including a 25 hp motor but that a smaller impeller be included. The impeller could be selected for 95 lb rather than 120 lb and if he was not satisfied with the resulting pressure at the header he could do one of two things: The pump impeller could be replaced with a size sufficient to provide the 120 lb, or the automatic control valves in the water distribution piping could be replaced. The pressure drop through these valves accounts for a large part of the total pressure drop, and by replacing them with larger sizes the total pressure drop could be considerably lowered.

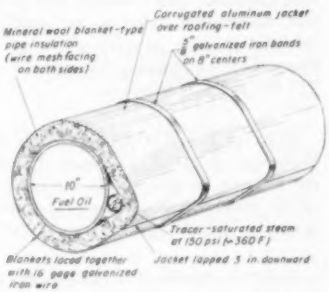
[You are invited to contribute discussion of a heating, piping or air conditioning problem — and suggestions for solving it — for publication here. Address The Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.]

Insulating Steam-Traced Oil Lines

AT THE GENERAL American tank storage terminal, Argo, Ill., two 10 in. oil lines carry heavy fuel oil from the manifold pit to storage tanks. The two lines are insulated and traced by parallel 2 in. steam pipes to prevent temperature drop in No. 5 and No. 6 oils, which are at 95 F and 140 F respectively. Maintenance of higher oil temperature insures low viscosity and facilitates pumping and handling in transit.

Mineral wool blanket sections, 24 in. long and 2 in. thick, with wire mesh facing on both sides, are wrapped around the two pipes and laced together with 16 ga galvanized metal wire. A 28 ga corrugated aluminum jacket, with an asphalt felt weatherproof liner applied to its inner surface, is then wrapped around the blankets. This jacket is lapped down 2 to 3 in. against the weather to prevent moisture entry and banded with $\frac{5}{8}$ in. galvanized metal bands on about 8 in. centers.

Details of the application of the insulation are given in the diagram, which also indicates how the insulation adapts itself to the contours of the adjoining pipes.


Corrugated aluminum jacket over roofing-felt
Mineral wool blanket-type pipe insulation (wire mesh facing on both sides)
5/8" galvanized iron bands on 8" centers
10" Fuel Oil
Tracer-saturated steam at 150 psi (=360 F)
Blankets laced together with 16 gage galvanized iron wire
Jacket lapped 3 in. downward

HERE ARE DETAILS of the steam tracer piping and the insulation

MEETINGS & CONVENTIONS

IBR SCHOOL OF MODERN HEATING — August 19 to 21, Providence; August 26 to 28, Albany; September 9 to 11, Detroit; September 16 to 18, Saginaw, Mich. Sponsored by The Institute of Boiler and Radiator Manufacturers, 60 E. 42nd St., New York 17. The school is a three day course providing instruction in the design and installation of hot water and steam heating systems.

EIGHTH ANNUAL NATIONAL CONFERENCE ON INDUSTRIAL HYDRAULICS — September 4 and 5, Sherman Hotel, Chicago. Sponsored by Illinois Institute of Technology, Technology Center, Chicago 16. It will be held in conjunction with the Centennial of Engineering.

INSTRUMENT SOCIETY OF AMERICA, 1319 Allegheny Ave., Pittsburgh 33 — Seventh national instrument conference and exhibit, September 8 to 12, Cleveland.

Papers to be presented on September 11 include:

Controls as Applied to the Carrier Conduit System, by L. Avery
Aircraft Cabin Temperature Control Systems, by S. D. Browne
Automatic Control System for an All-Year Air Conditioner, by H. C. Shagaloff
Controlling Domestic Oil-Fired Heating Equipment, by C. F. Suesserott

The Fourth Preconference ISA Instrument Maintenance Clinic will be operated during September 5 to 7, prior to the regular conference. The program will include such subjects as thermal elements, pressure and primary flow elements, pneumatic positioning devices, etc.

The clinic of the analysis instrumentation committee, consisting of a lecture and demonstration course on complex analytical instruments, will be held in conjunction with the main meeting, September 8 to 12. Admission is by previous registration, forms for which may be obtained by writing Dr. Axel H. Peterson, Mellon Institute, 4400 Fifth Ave., Pittsburgh 13.

The society's national conference and exhibit will be held September 21 to 25, 1953, Chicago, and the first international instrument congress and exhibit will be held September 14 to 24, 1954, in conjunction with the ninth national conference and exhibit.

SIXTH SHORT COURSE IN HOT WATER AND STEAM HEATING — September 9 to 11, Urbana, Ill. Sponsored by the University of Illinois in cooperation with The Institute of Boiler and Radiator Manufacturers. Among subjects covered will be heating and ventilation load estimates, panel heating and snow removal application, heating unit selection and application, etc. Further information may be obtained from Robert K. Newton, Supervisor, Engineering Extension, University of Illinois, 715 Wright St., Champaign.

SEVENTH NATIONAL CHEMICAL EXPOSITION— September 9 to 13, Coliseum, Chicago. Sponsored by the Chicago Section of the American Chemical Society, 86 E. Randolph St., Chicago 1. An exhibit on atomic energy in industry will be part of the exposition.

SOUTH CENTRAL REGION, NATIONAL ASSOCIATION OF CORROSION ENGINEERS, 1061 M & M Bldg., Houston 2 — October 1 to 3, New Orleans.

AMERICAN INSTITUTE OF WHOLESALE PLUMBING AND HEATING SUPPLY ASSOCIATIONS, INC.— First national convention, October 19 to 22, Chalfonte-Haddon Hall Hotel, Atlantic City, N.J. For further information write G. T. Underwood, executive secretary, Room 402, Albee Bldg., 15th and G Sts., Washington, D.C.

40th NATIONAL SAFETY CONGRESS AND EXPOSITION — October 20 to 24, Chicago. Sponsored by the National Safety Council, 425 N. Michigan Ave., Chicago.

AMERICAN GAS ASSOCIATION, 420 Lexington Ave., New York 17 — 34th annual convention, October 27 to 30, Atlantic City, N.J. An exhibit by the Gas Appliance Manufacturers Association will be held concurrently.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS, 40 W. 40th St., New York 18 — 38th annual meeting, November 30 to December 3, Hotel Commodore, New York.

20th NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING — December 1 to 6, Grand Central Palace, New York. Management of the show is the International Exposition Co., Grand Central Palace, New York 17. It is held under the auspices of the American Society of Mechanical Engineers, whose annual meeting will be in session during the same week.

NATIONAL WARM AIR HEATING AND AIR CONDITIONING ASSOCIATION, 145 Public Square, Cleveland 14. — 39th annual convention, December 3 and 4, Sheraton Gibson Hotel, Cincinnati.

10th REFRIGERATION AND AIR CONDITIONING EDUCATIONAL EXHIBIT AND CONFERENCE — December 5 to 7, Miami. Sponsored by the Refrigeration Equipment Manufacturers Association, 1346 Connecticut Ave., N.W., Washington 6, D. C. Annual meetings of the Refrigeration Service Engineers Society and the Refrigeration and Air Conditioning Contractors Association will be held in Miami at the same time, followed by a joint meeting of the manufacturers and wholesalers on December 8 and 9, Hollywood Beach, Fla.

PLANT MAINTENANCE CONFERENCE AND SHOW — January 19 to 22, 1953, Public Auditorium, Cleveland. Management of the show is Clapp & Poliak, Inc., 341 Madison Ave., New York 17.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, 62 Worth St., New York 13 — 59th annual meeting, January 26 to 30, Conrad Hilton Hotel, Chicago.

11th INTERNATIONAL HEATING & VENTILATING EXPOSITION — THE AIR CONDITIONING EXPOSITION — January 26 to 30, 1953, International Amphitheatre, Chicago. Held under the auspices of The American Society of Heating and Ventilating Engineers. Address inquiries to the exposition management, International Exposition Co., Inc., Grand Central Palace, New York 17.

Heating, Piping & Air Conditioning

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

JOURNAL *SECTION*

Cooling Load from Sunlit Glass

By C. O. Mackey* and N. R. Gay**, Ithaca, N. Y.

SUMMARY — This is a preliminary study of the relation between cooling load and the instantaneous rate of heat gain from sunlit glass. A mathematical solution is developed and a problem is solved mathematically for stated conditions to obtain the instantaneous cooling load per square foot of floor and relation of this load to the instantaneous rate of gain of radiant energy.

The mathematical results were compared with performance of a fluid analogue in which the problem conditions were simulated by resistance of fluid circuits, volume of flow, fluid heads, etc. The results obtained with the analogue demonstrated its accuracy and the possibility of using the analogue, with modifications, for solving more complex problems of heat transfer in the study of cooling loads.

IT HAS BEEN recognized for some time that radiant energy does not become a cooling load on air conditioning equipment of conventional design until absorbed by some surface and transferred by convection to air. This process is usually accompanied by a storage of energy; the heat transfer relationships become very complex and the variables are so many that there is little hope that cooling loads will ever be calculated with extreme precision. Much more information is needed at this time on the relationship between the peak cooling load and the maximum instantaneous rate of heat gain which is causing the load.

The relation between cooling load and the instantaneous rate of heat gain from sunlit glass is given preliminary study in this paper. The energy that reaches the interior of a structure through glass is made up of four parts: (1) transmitted direct solar radiation; (2) transmitted sky or diffuse radiation; (3) energy radiated from the room surface of the glass to surrounding surfaces within the enclosure; (4) heat transferred from the room surface of the glass to indoor air by convection. Only the last part, which is commonly a small portion of the total, is an immediate cooling load. Solar and sky radiation directly transmitted by a window will usually fall on a floor. The energy may be (1) conducted away from the floor surface with accompanying heat storage and changing temperature of the floor material, (2) convected from floor surface to indoor air, and (3) radiated from the floor surface to other room surfaces that *see* the floor. Energy that is radiated from the room surface of the glass is incident upon floor, ceiling, walls, and other room surfaces. These materials act, in turn, somewhat like the floor, and there is a transfer of heat by convection from these surfaces to the indoor air.

The problem solved in this paper has been set up with many simplifying assumptions, primarily for the purpose of making possible a precise mathematical solution. A fluid analogue and a pump with periodic, variable delivery were constructed to solve the same problem. Results obtained on the analogue may then be compared with results of the mathematical analysis. In this way, the performance of the analogue may be checked, and the analogue, if satisfactory, may then be changed to solve problems that are too complex for reasonable mathematical solution.

Mathematical Statement and Solution of Problem

Assume that solar and sky radiations directly transmitted by glass fall uniformly on a floor surface. The rate at which radiation is incident upon the floor surface is I Btu per (hr) (sq ft), which is equal to the rate at which the energy is transmitted per square foot of glass divided by the ratio of the area of the floor to the area of the glass, or

$$I = I_s/p \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

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Presented at the Semi-Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Spring Lake, N. J., June 1952.

In general, I will be expressed by a Fourier series as a function of time θ or

$$I = I_m + I_1 \cos (15\ \theta - a_1) + I_3 \cos (30\ \theta - a_3) + \ldots (2)$$

Assume that the thickness of the floor is L ft, that the thermal conductivity of the homogeneous floor material is k Btu per (hr) (sq ft) (F deg per ft) and that the thermal diffusivity of the floor is a sq ft per hr. The remote surface of the floor is assumed to be adiabatic, and conduction of heat is assumed to be in one direction (perpendicular to the floor surface). The floor surface convection coefficient of heat transfer is h_L Btu per (hr) (sq ft) (F deg). Completely surrounding the floor is assumed to be an enclosure with no storage capacity and with a remote adiabatic surface. The ratio of the area of the enclosure to the area of the floor is r, and the enclosure surface coefficient of heat transfer by natural convection is h_e Btu per (hr) (sq ft) (F deg).

It is assumed that the temperature of the air in the enclosure is held constant at t_a. There is no way for energy to escape from the enclosure, so that in a complete cycle of 24 hr duration, the quantity of energy that enters through the glass must be transferred to the air. It is required, however, to find the instantaneous rate at each hour that heat is transferred from the floor and enclosure surfaces to the room air; this is the cooling load. Incidental to this solution, the uniform temperature of the room surface of the floor and the uniform temperature of the room surface of the enclosure are found as a function of time.

It is assumed that the rate of transfer of energy by radiation from the floor to enclosure is h_r Btu per (hr) (sq ft) for each degree of temperature difference between floor surface at t_L and enclosure surface at t_e. At the adiabatic surface of the floor, $x = 0$, and at the room surface of the floor, $x = L$. The energy balance on the room surface of the floor is

$$I = h_L(t_L - t_a) + h_r(t_L - t_e) + k\left(\frac{\partial t}{\partial x}\right)_{x=L} \quad \ldots\ldots (3)$$

The energy balance on the enclosing surface is

$$h_e\ (t_e - t_a) + (h_r/r)\ (t_e - t_L) = 0 \quad \ldots\ldots (4)$$

For the unsteady state conduction of heat in one direction through the floor slab,

$$\frac{\partial t}{\partial \theta} = a\left(\frac{\partial^2 t}{\partial x^2}\right), \text{ for } 0 < x < L \quad \ldots\ldots (5)$$

Nomenclature

- A = area of floor, square feet.
- a = thermal diffusivity of the floor, square feet per hour.
- c = specific heat of the floor, Btu per (pound) (Fahrenheit degree).
- h_e = coefficient of heat transfer by natural convection from enclosure surface, Btu per (hour) (square foot) (Fahrenheit degree temperature difference between enclosure and air).
- h_L = coefficient of heat transfer by convection from floor, Btu per (hour) (square foot) (Fahrenheit degree difference between floor surface and air).
- h_r = rate of transfer of energy by radiation from floor to enclosure, Btu per (hour) (square foot) (Fahrenheit degree temperature difference between floor and enclosure surface).
- I = rate of incident radiation upon floor surface, Btu per (hour) (square foot).
- I_g = rate of transmission of solar and sky radiation by glass, Btu per (hour) (square foot of glass).
- k = conductivity of homogeneous floor, Btu per (hour) (square foot) (Fahrenheit degree temperature difference per foot).
- L = thickness of floor, feet.
- n = term number in the Fourier series (1 for fundamental, 2 for second harmonic, etc.)
- p = ratio of floor area to glass area.
- q = cooling load, Btu per hour.
- r = ratio of enclosure area to floor area.
- t_a = temperature of air in enclosure, Fahrenheit.
- t_e = temperature of enclosure surface, Fahrenheit.
- t_L = temperature of floor surface, Fahrenheit.
- β = lag angle, degrees.
- θ = time after noon, hours.
- λ = decrement factor.
- ρ = density of the floor, pounds per cubic foot.

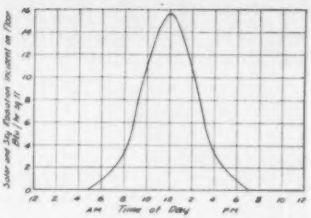


Fig. 1 — Instantaneous rate of heat gain

The last equation is subject to one boundary equation given in Equation 3 and to Equation 6.

At $x = 0$

$$\frac{\partial t}{\partial x} = 0 \quad \ldots\ldots (6)$$

The solution for the temperature of the room surface of the floor as a function of time is

$$t_i = t_a + \frac{I_m}{F} + \sum \frac{\lambda_n I_n}{F} \cos(\omega_n \theta - \alpha_n - \beta_n) \quad (7)$$

where

$$F = h_i + h_r - \frac{\frac{1}{r}}{\frac{1}{r} + h_e} \quad \ldots\ldots (8)$$

$$\lambda_n = \sqrt{V_n^2 + W_n^2} \quad \ldots\ldots (9)$$

$$\beta_n = \tan^{-1}(W_n/V_n) \quad \ldots\ldots (10)$$

$$V_n = (f_n \cos \sigma_n L \cosh \sigma_n L + g_n \sin \sigma_n L \sinh \sigma_n L) \div (f_n^2 + g_n^2) \quad \ldots\ldots (11)$$

$$W_n = (g_n \cos \sigma_n L \cosh \sigma_n L - f_n \sin \sigma_n L \sinh \sigma_n L) \div (f_n^2 + g_n^2) \quad \ldots\ldots (12)$$

$$f_n = \cos \sigma_n L \cosh \sigma_n L - (k\sigma_n/F)(\sin \sigma_n L \cosh \sigma_n L - \cos \sigma_n L \sinh \sigma_n L) \quad \ldots\ldots (13)$$

$$g_n = \sin \sigma_n L \sinh \sigma_n L + (k\sigma_n/F)(\sin \sigma_n L \cosh \sigma_n L + \cos \sigma_n L \sinh \sigma_n L) \quad \ldots\ldots (14)$$

$$\sigma_n = \sqrt{\frac{0.1309n}{a}} \quad \ldots\ldots (15)$$

After t_L and t_e are found, the cooling load, in Btu per hour for each square foot of floor, is

$$q/A = h_L\ (t_L - t_a) + rh_e\ (t_e - t_a) \quad \ldots\ldots (16)$$

It should be carefully noted that this is a solution of a problem of heat flow in the periodic state. The solar

and sky radiation transmitted by the glass is assumed to be the same at a given hour day after day. In this respect, the problem differs from transient state problems previously solved on the fluid analogue, where, with the starting conditions known, a load was suddenly applied and temperatures and cooling loads were found as a function of time after the first occurrence of the load.

A solution of the problem will be given for a particular case. In this example, the thickness of the floor is $L = 0.5$ ft; the floor is assumed to be made of cinder concrete with $k = 0.41$ Btu per (hr) (sq ft) (F deg per ft), and $a = 0.02$ (sq ft) (hr).

The rate at which solar and sky radiation transmitted by glass is incident on the floor is given in Fig. 1. These data are for south glass on August 1 in a north latitude of 40 deg and for a ratio of floor area to glass area of 6. The Fourier series fitted to this curve is

$$I = 3.83 + 6.33 \cos 15\theta + 3.58 \cos 30\theta + 1.42 \cos 45\theta \quad \ldots\ldots(17)$$

where

θ = hours after noon, sun time.

Note that the lag angle, α, has disappeared from this particular series because the curve is symmetrical about noon.

The ratio of area of enclosure to floor has been taken as $r = 3.55$; also $h_L = 0.7$, $h_r = 1$, and $h_c = 0.4$. Incidental to the solution, the following results were found:

$F = 1.287$; $\lambda_1 = 0.476$; $\beta_1 = 28.5°$; $\lambda_2 = 0.396$; $\beta_2 = 27.8°$; $\lambda_3 = 0.356$; $\beta_3 = 29.4°$

The solution for t_L is

$$t_L = t_a + 2.97 + 2.341 \cos (15\theta - 28.5) + 0.9477 \cos (30\theta - 27.8) + 0.3928 \cos (45\theta - 29.4) \quad \ldots\ldots(18)$$

For example, at noon, $\theta = 0$, and the instantaneous difference between the temperature of the room surface of the floor and the room air is $t_L - t_a = 6.21$ F.

From Equation 4, the instantaneous difference between the temperature of the room surface of the enclosure and the room air is

$$t_s - t_a = 2.57 \text{ F}$$

The instantaneous cooling load per square foot of floor is

$$q/A = 0.7\ (6.23) + 0.4\ (3.55)\ (2.57) = 8.0 \text{ Btu per hr}$$

The instantaneous rate at which radiant energy is being transmitted through the window glass is 94/6 or 15.7 Btu per (hr) (sq ft of floor). Consequently, the instantaneous cooling load in this one example is 51 percent of the instantaneous rate of gain of radiant energy.

The Fluid Analogue

Through the generous assistance of Charles S. Leopold, a fluid analogue was set up at *Cornell University* to solve the same problem for which the precise mathematical solution has been given. The scales used in the analogue were 1 in. change in level of the liquid to represent 1 F deg change in temperature and a time interval of 1 min to represent a time interval of 1 hr in the prototype. The floor was assumed to be of cinder concrete and was divided into slabs of 1 in. thickness; any floor thickness up to 10 in. in increments of 1 in. could be studied. The analogue is shown in Fig. 2. Details of the construction of the analogue will not be given in this paper. In building the analogue, the area of cross section of each storage tube must be chosen in relation to the scales to represent the heat storage capacity of a thickness of 1 in. of cinder concrete with an area of 1 sq ft. The resistances to fluid flow between storage tubes provided by the copper tubing must simulate the thermal resistance of 1 in. of cinder concrete. The resistances to fluid flow between the floor surface and the air tube and between the enclosure surface and the air tube must simulate the resistance to convection of heat between the corresponding surfaces, while the resistance to fluid flow between the floor surface and the enclosure surface must simulate the resistance to transfer of radiant energy between these surfaces. The flow of the liquid must be laminar at all times. Silicone oil was used in the Cornell analogue for many reasons, but principally because the change of kinematic viscosity of this oil with temperature change is small; a change in kinematic viscosity from calibration conditions requires a change in some of the scales.

Many interesting problems were encountered in the construction and use of the analogue. A positive displacement pump was built to reproduce the variable and periodic transmission of radiant energy through south glass. A flow of 8 cc per min was used to represent heat transfer at the rate of 1 Btu per (hr) (sq ft of floor); the pump with its south glass cam was then designed to reproduce the delivery cycle shown in

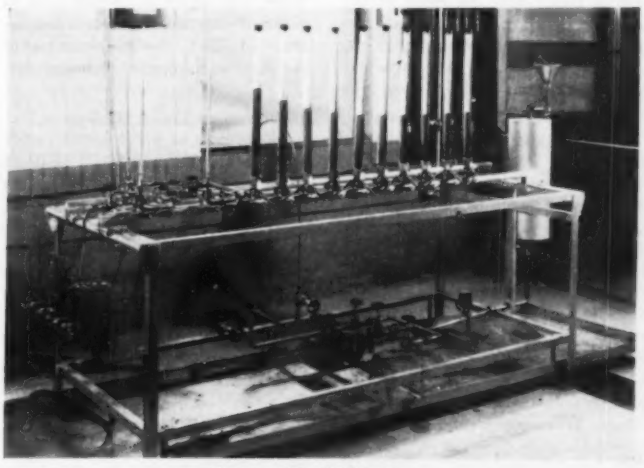


Fig. 2 — The fluid analogue

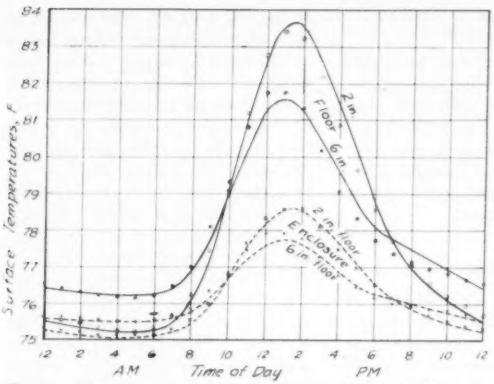


Fig. 3 — Temperatures of room surfaces for two floor thicknesses

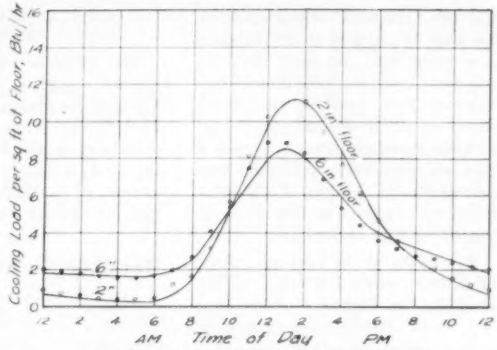


Fig. 4 — Cooling loads for two floor thicknesses

Fig. 1 every 24 min. In other words, between shortly after 7 p.m. and shortly before 5 a.m., there was no delivery from the pump; during the daylight hours, the pump delivery increased to a peak of 125 cc per min at noon and then decreased. By changing cams on this pump, any combination of orientation, latitude, and solar declination may be reproduced.

In representing periodic heat flow by a fluid analogue, the correct starting levels of the liquid in the several tubes are, of course, unknown. In each test, the level of the liquid in all the tubes was the same at the beginning; enough cycles were then run to insure that the effect of the incorrect starting condition was removed. In other words, enough cycles were run so that, at a particular time, the liquid level in each tube was the same in the last cycle as in the preceding cycle. Another check on the attainment of correct conditions is in the total collection of liquid in 24 min; with no net storage effect in 24 min, the total quantity of liquid collected in one cycle must be the same as the total delivery of the pump in one cycle; in the example, this total delivery was 735 cc.

The performance of the analogue is shown in Figs. 3 and 4 by comparison with the results calculated from the mathematical theory. The mathematical results are shown by lines, while the analogue results are plotted as points. Results are presented for two thicknesses of the floor: 2 in. and 6 in. Based upon an assumed constant indoor air temperature of 75 F, the temperatures of the floor surface and enclosure surface are shown in Fig. 3, while the cooling loads are shown in Fig. 4. Clearly, the analogue gave results that are in close agreement with the precise mathematical solution, and the fluid analogue must be considered an effective tool for solving some of the more complex problems.

Discussion of Results

For the south glass, the cinder concrete floor, and the other arbitrary assumptions of the example, the surface of the 2-in. floor reaches a peak temperature that is 8.7 F deg higher than the constant temperature of the air, while the surface of the 6-in. floor attains a peak temperature only 6.6 deg higher than the air temperature. The lag in time between the time of maximum incident radiation and the maximum temperature of the floor surface is between 1.0 and 1.5 hr. The maximum cooling load for

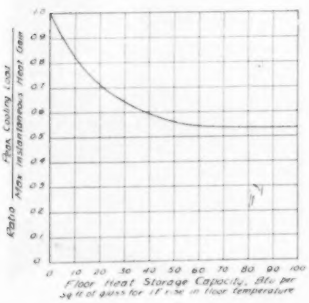

Ratio Max. Cooling Load / Max. Instantaneous Heat Gain
Floor Heat Storage Capacity, Btu per sq ft of glass for 1F rise in floor temperature

Fig. 5 — Effect of storage capacity on ratio of cooling load to heat gain

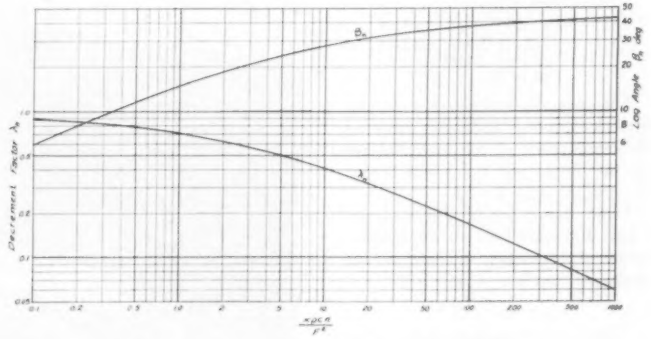


Fig. 6 — Decrement factors and lag angles for thick floors

the 2-in. floor is 11.2 Btu per (hr) (sq ft of floor), and for the 6-in. floor this peak load is 8.5 Btu per (hr) (sq ft). The ratio of this peak cooling load to the maximum instantaneous rate of heat gain is 0.72 for the 2-in. floor and 0.54 for the 6-in. floor.

For west glass in the same latitude, the peak cooling load with a 6-in. floor was found to be 17.6 Btu per (hr) (sq ft of floor), which is 55 percent of the maximum instantaneous rate of heat gain. The ratio of cooling load to heat gain is not materially affected by the orientation of the glass.

Based upon calculated results, the ratio of the peak cooling load to the maximum instantaneous rate of heat gain is shown plotted in Fig. 5 against the energy storage capacity of the floor per square foot of sunlit glass, expressed in Btu per F deg rise in temperature of the floor material. For example, the volumetric specific heat of cinder concrete is 20.5 Btu per (cu ft) (F deg); with 6 sq ft of floor per sq ft of glass and a floor thickness of 6 in., the energy storage capacity per sq ft of glass is 20.5 (6) (0.5) or 61.5 Btu per F deg rise in temperature of the concrete. This storage capacity is the principal variable that affects the ratio of cooling load to heat gain. It is thought that this curve might be characteristic of other similar problems with storage effects. It should be noted that the ratio of peak cooling load to peak heat gain is not decreased in proportion to the amount of material in which energy may be stored. This is primarily because heat is entering a surface of the material and may then be transferred from that *same* surface to the air without passing through the material. In this respect, storage of radiant energy that passes through sunlit glass differs from storage in a sunlit wall or roof of a structure; heat then enters the weather side of the material and must pass through the material (with some storage) before it is transferred to the air from inside surfaces. A continuous increase in the thickness of a wall or roof causes a continuous increase in time lag and a continuous decrease in the ratio of cooling load to heat gain. Increasing the thickness of the floor from 6 in. to 10 in. in the case solved in this paper, for example, does not further decrease the cooling load or increase the time lag.

In this connection, there is a simpler mathematical solution of the case previously solved for large values of $\sigma_n L$; when $\sigma_n L > 2.5$, $\sinh \sigma_n L$ is approximately the same as $\cosh \sigma_n L$; then, for values of L greater than $6.9\ (a/n)^{1/2}$,

$$\lambda_n = \sqrt{\frac{1}{1+\frac{k\sigma_n}{F}+2\left(\frac{k\sigma_n}{F}\right)^2}} \qquad (19)$$

and

$$\beta_n = \tan^{-1}\left(\frac{\frac{k\sigma_n}{F}}{1+\frac{k\sigma_n}{F}}\right) \qquad (20)$$

The decrement factors and lag angles are shown in Fig. 6 for this case. For example, if the thickness of a cinder concrete floor is greater than $6.9\ (0.02)^{1/2}$ or 0.975 ft (11.7 in.), values of the fundamental decrement factor λ_1 and fundamental lag angle β_1 may be read from this chart; in this case,

$$k\rho cn/F^2 = 0.41(20.5) / (1.287)^2 = 0.508 \quad \lambda_1 = 0.78 \text{ and } \beta_1 = 11.6 \text{ deg}$$

also, if the thickness of a cinder concrete floor is greater than 8.3 in., the second harmonic decrement factor λ_2 and lag angle β_2 may be found from Fig. 6; then,

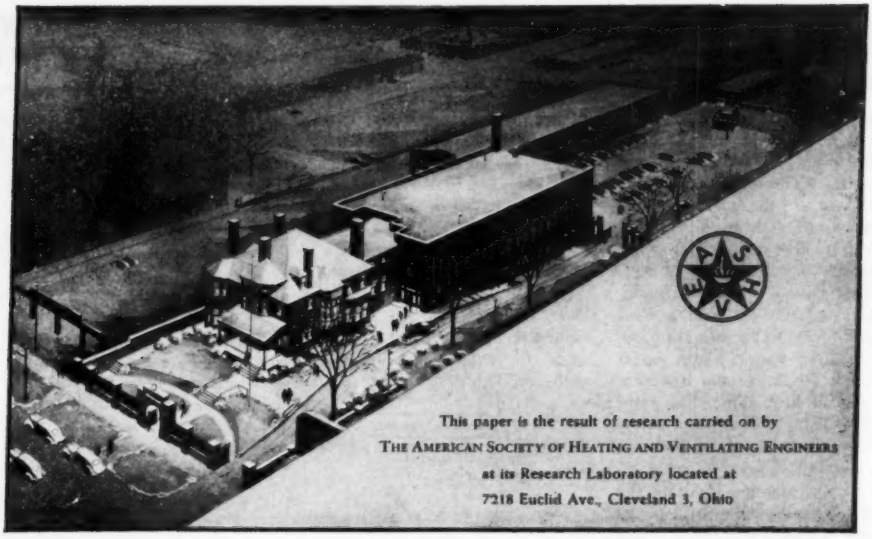
$$(k\rho cn/F^2) = 1.016, \quad \lambda_2 = 0.71 \text{ and } \beta_2 = 15 \text{ deg}$$

One problem much more quickly solved on the analogue than by mathematical methods is any case where the temperature of the room air is not assumed to be constant. In one run on the analogue for the 6-in. floor, there was assumed to be no cooling from 6 p.m. to 6 a.m., while the indoor air temperature was assumed to be constant at 75 F during the remainder of the day. A maximum cooling load of 10.7 Btu per (hr) (sq ft of floor) was then found shortly after noon; this load is 68 percent of the maximum instantaneous rate of heat gain, a figure which may be compared with the 54 percent realized when the indoor air temperature was assumed to be held at 75 F at all times. In this same case, the indoor air reached a maximum temperature of 80.7 F just before the cooling began at 6 a.m.

Another case solved on the analogue for the 6-in. floor was the effect of night setback of indoor air temperature and the consequent precooling upon the maximum cooling load on the following day. In this case, the indoor air temperature was assumed to be held constant at 75 F between 6 a.m. and 6 p.m., while the thermostat was set for 69 F during the evening (a night setback of 6 deg). In this case, the maximum cooling load was 6.8 Btu per (hr) (sq ft of floor) at 1 p.m.; this peak cooling load is 43 percent of the maximum instantaneous rate of heat gain, a result which may be compared with 54 percent for the constant indoor air temperature of 75 F all day or with the 68 percent found when there was no cooling during the evening.

It is proposed to use the fluid analogue to continue the study of the relation between cooling loads and instantaneous rates of heat gain. The simple problem presented here has permitted a determination of the accuracy of the analogue by comparison with a precisely known result. The assumptions that the only cooling load resulted from sunlit glass and that the only storage capacity was in the floor, although useful simplifications, are obviously not real. A much more complex problem involves simultaneous periodic heat flow through a roof, variously oriented walls, and sunlit glass with capacity for energy storage in roof, walls, floors and even furnishings. By building other additional pumps, storage tubes, and resistance loops, such problems may be set up on the analogue. The precise mathematical solution involves the simultaneous solution of partial differential equations of the second order for roof, walls, and floors and most engineers would wish to avoid having to make such a solution.

The analogue also makes readily possible the investigation of results obtained by using shading devices to decrease cooling loads.


This paper is the result of research carried on by
THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
at its Research Laboratory located at
7218 Euclid Ave., Cleveland 3, Ohio

Exploration of a Chilled Jet

By H. B. Nottage*, J. G. Slaby**, and W. P. Gojsza**, Cleveland, Ohio

SUMMARY — Data and interpretations are reported for a chilled ventilation jet discharging horizontally and falling to the floor under the action of buoyant forces. A single outlet-flow condition was employed in this initial exploratory test, namely 500 fpm mean outlet velocity, corrected to standard density, and a mean temperature depression of 39 F deg below the surrounding air. An evaluation of the forces and moments acting on the jet establishes the basis for analyzing the vertical drop of the jet axis. A simple empirical relationship is suggested for calculating this vertical drop, subject to validation by further and more extensive data. Fundamental consideration is given to the turbulent Prandtl number, whose magnitude is found to agree with the limited data available from other studies.

THE GENERAL topic of non-isothermal ventilation jets in room air distribution is of broad practical importance in the long-range ASHVE research program.[1] The study reported is merely an initial exploration of non-isothermal conditions, concerned primarily with examining the physical principles governing the motion of a horizontally-projected chilled jet. The Technical Advisory Committee on Air Distribution† has given general guidance.

Scope

The experimental installation has been described previously[2]. The six-inch long-radius *ASME* standard nozzle was retained as the jet outlet. The single test condition employed was a mean outlet velocity of 500 fpm, corrected to standard air having a density of 0.075 lb per cu ft, and a mean outlet temperature depression of 39 F deg below the surrounding room air temperature. The test space was quite large. The experiments were conducted during the heating season, so that the surrounding room air temperature could be held constant.

Because of the general lack of fundamental understanding concerning chilled ventilation jets, the study reported here was devoted primarily to an examination of fundamental principles. The experimental work was conducted with great care and in comprehensive detail, seeking rational guidance for the all-important practical application type of tests which still are needed to establish handbook-style information for the engineer's daily use.

In harmony with the isothermal studies reported previously[2], the guiding viewpoint has been to determine what takes place within the moving body of a chilled jet of air, and to formulate interpretations based upon the velocities, temperatures, forces, and moments which govern the observed behavior.

Experimental Procedure

The general test methods have been noted previously[2].

The jet flow rate was established by use of a standard orifice located

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[1]Exponent numerals refer to References.

†*Personnel:* G. B. Priester, *Chairman;* H. F. Brinen, R. M. Conner, S. H. Downs, Linn Helander, F. B. Holgate, W. O. Huebner, W. W. Kennedy, R. D. Madison, G. E. McElroy, L. G. Miller, H. C. Pierce, C. H. Randolph, T. H. Troller, R. D. Tutt, G. L. Tuve.

Presented at the Semi-Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Spring Lake, N. J., June 1952.

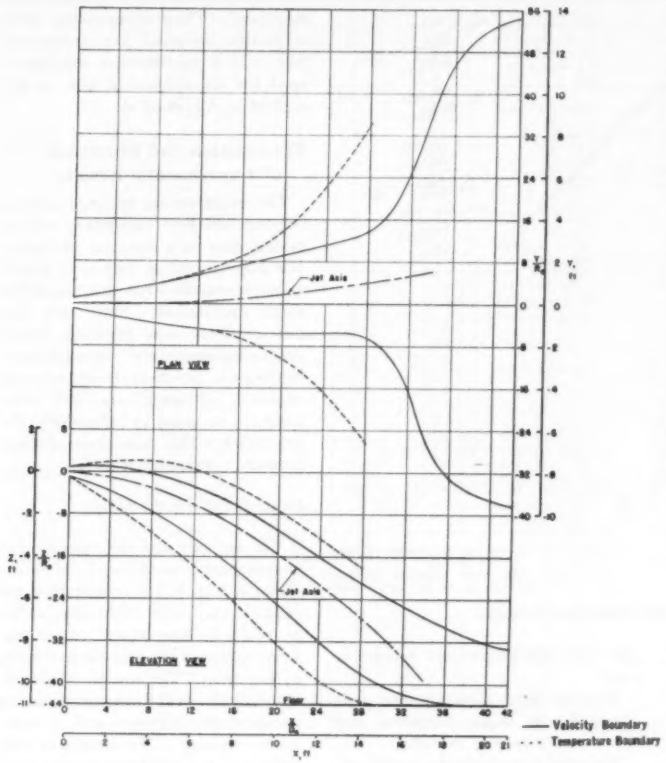


Fig. 1—Plan and elevation views of chilled-jet velocity and temperature boundaries

ahead of the cooling coils. This location enabled the mass flow rate to be fixed conveniently, independent of the setting of the outlet temperature of the jet.

Very careful attention was necessary to hold the outlet temperature depression of the jet at 39 ±1.5 F deg, otherwise reproducible data could not be obtained. This was accomplished by continual manual adjustment of (1) the chilled-water temperature to the first of the two cooling coils, and (2) the control point of the suction-pressure controller for the compressor connected to the second or direct-expansion cooling coil.

Icing of the cooling coil was the major factor in limiting the jet outlet temperature depression to 39 deg. De-icing was generally necessary once each day at this condition. The fan intake air was room air at normally-encountered humidity ratios and a temperature of approximately 70 F.

Once the desired outlet conditions were achieved, the operating procedure comprised a thorough and careful sequence of criss-crossing profiles to establish temperatures and velocity vectors throughout the jet flow region.

Temperature data were obtained mostly with shielded copper-constantan thermocouple probes. For the lowest jet-to-surroundings temperature differences, a three-junction thermopile was employed. All temperature readings were shown on a recording potentiometer chart as emf differentials of jet to surrounding air. In vertical traverses, the slight vertical stratification in the surrounding air was included by traversing the surrounding-air thermo-junction parallel to the jet-air thermo-junction.

A special technique was necessary to locate what has been designated as the *temperature boundary* of the jet region. This boundary was taken as the locus of positions where the radial temperature gradient, in approaching the jet axis from the surroundings,

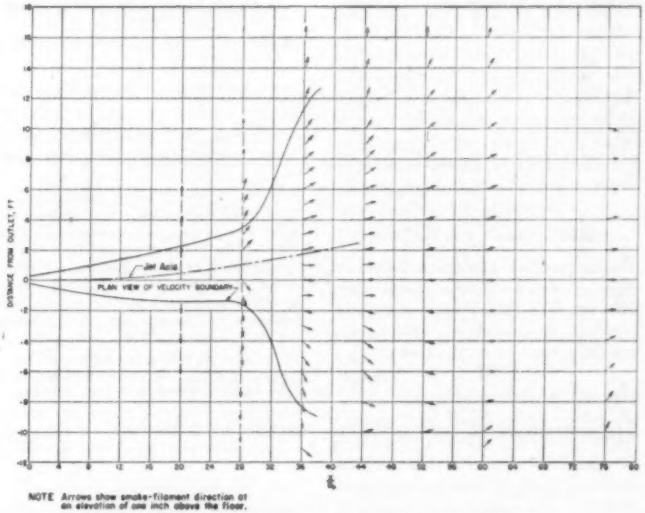
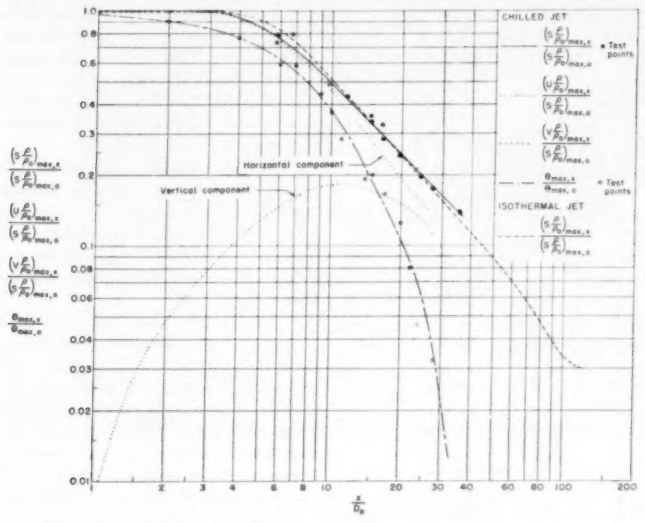

Jet Axis
PLAN VIEW OF VELOCITY BOUNDARY
DISTANCE FROM OUTLET, FT
NOTE Arrows show smoke-filament direction at an elevation of one inch above the floor.

Fig. 2—Plan view of the *splash* flow along floor with chilled jet



$S\ (\rho/\rho_0)$ = Resultant axial velocity, fpm

$U\ (\rho/\rho_0)$ = Horizontal velocity component, fpm

$V\ (\rho/\rho_0)$ = Vertical velocity component, fpm

θ = Temperature difference between surrounding air and jet, F deg

Fig. 3—Axial velocity and temperature difference

first attained an appreciable magnitude. This magnitude was taken as 0.03 F deg per in. after an exploratory study of reproducibility in gradient measurements. Experimental operation here was facilitated by directly connecting a three-junction thermopile to a reflecting-mirror galvanometer.

Velocity-vector direction data were obtained with smoke filaments[3] and the V-wire direction probe[4].

Velocity magnitude data were obtained with heated-thermocouple anemometers[5]. These anemometers were originally designed for isothermal flow, and a modification was developed for non-isothermal flow as described in Appendix A.

Presentation and Discussion of Experimental Results

The experimental findings and interpretations lend themselves well to presentation as a sequence of topics. The objective of an improved physical understanding has dominated the entire exploration. Since only one test condition was involved, broad generalizations are unwarranted. Neither can practical design rules be expected, although practical judgment can be aided by reference to the principles which have been demonstrated in quantitative form.

General Path of the Flow

The jet axis and the velocity and temperature boundaries of the jet are shown in Fig. 1. The temperature and velocity axes were coincident as far as could be ascertained experimentally, except in the immediate vicinity of the outlet. These axes were taken, respectively, as the lines of maximum temperature difference and of maximum velocity. Temperatures and velocities along the jet axis serve as convenient reference quantities to

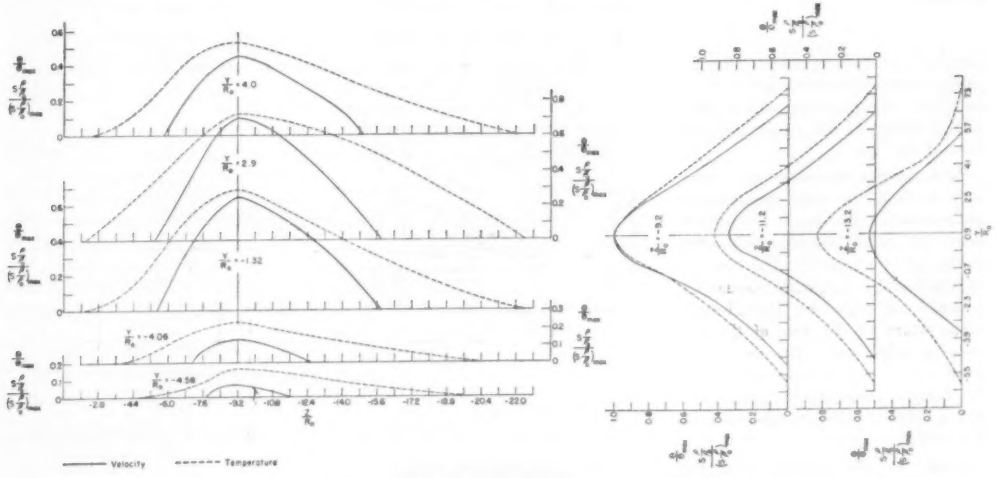


Fig. 4—$x/D_0 = 15$, chilled-jet velocity and temperature profiles

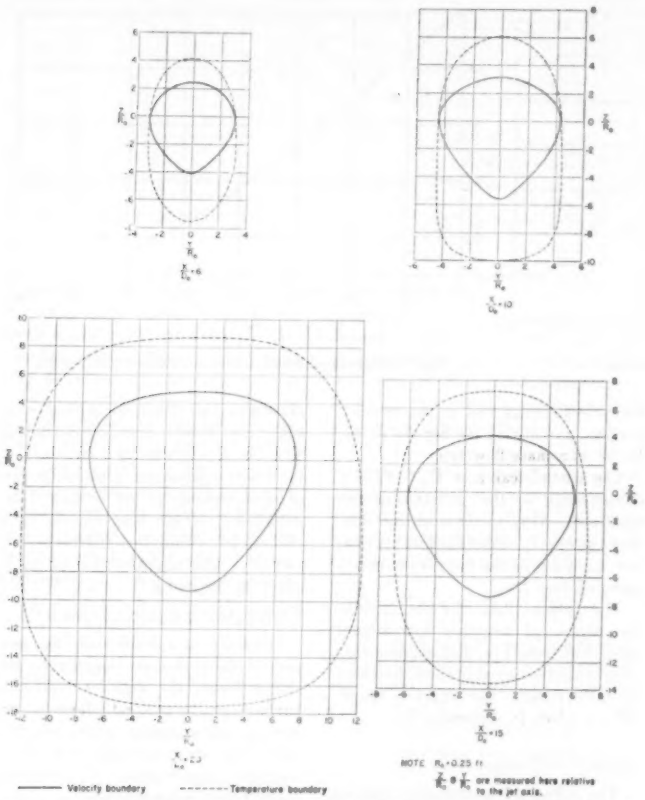


Fig. 5—Chilled-jet velocity and temperature boundary contours taken in vertical planes

which may be tied the cross-jet profiles of temperature and velocity.

The velocity boundary was taken as the position of zero velocity component in the direction of the jet axis, and was established from vector-direction data. Outside of the velocity boundary, the flow was moving back towards the outlet until entrained by the outflowing jet.

The temperature boundary was taken as the position where the radial temperature gradient attained its consistent threshold magnitude of 0.03 F deg per in. The ending of the temperature boundaries in Fig. 1 signifies the limit of reproducible temperature-boundary data. At this point there is still an axial temperature difference, but the temperature-difference field disappears rapidly as the distance from the outlet is further increased.

The comparison of boundaries leads to the following observations:

1. The more rapid spread of the temperature field as compared to the velocity field demonstrates that heat transfer within the fluid takes place at a greater rate than does momentum transfer. From this it may be concluded that the temperature and velocity profiles across the jet will be dissimilar; *i.e.*, they cannot be represented by the same dimensionless curve.

2. The outflowing jet is surrounded by a reverse-flow region of *chilled air*. This may be beneficial from the standpoint of mixing and cooling the air in an enclosed space, but the detrimental possibilities of cool drafts need to be recognized.

The slight curvature of the axis in the plan view of Fig. 1 was caused by the gradual cross-circulation of the room air in the test space. This cross-circulation was downward along the cool outer wall of the building, and then across the floor toward the center of the room. Room air currents of this nature need to be recognized in practical applications.

The rapid vertical drop of the jet axis is a significant demonstration of buoyant-force action. Although the buoyant force is small (its magnitude will be presented subsequently), the other forces acting are likewise small. The entire flow field is subject to severe distortion from interference such as could be caused by moving objects, obstacles (especially if they are either heated or chilled), or other air currents.

The behavior of the jet upon striking the floor is significant from the practical question of the feeling of *cold about the ankles*. The underside of the jet, upon approaching the floor, undergoes a billowing, reversing and spreading motion. The spreading action along the floor is somewhat like a water stream striking a plane surface obliquely. Test observations showed that, after striking the floor, the flow comprised a main stream, which continued in the direction of increasing distance from the outlet, plus a floor-surface movement which, under test conditions, was confined to a layer roughly three inches over the floor surface. A qualitative smoke-filament survey of the flow at a height of one inch above the floor is shown in Fig. 2. A very interesting behavior can be imagined in this connection if the floor were either heated or cooled, whereby a vertical convection movement would be superposed.

Temperature and Velocity Fields

The axial velocity and temperature-difference results are shown in Fig. 3. The close comparison with the corresponding isothermal-jet velocity may be fortuitous and cannot be generalized.

It is to be emphasized that the axial velocity and temperature curves are noticeably dissimilar, thereby demonstrating the inaccuracy of any assumption that they might be identical. The more rapid falling off of the temperature curve is consistent with the

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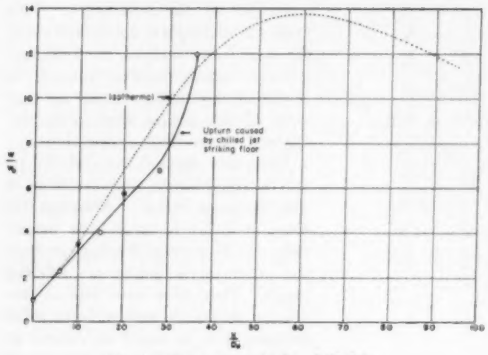

Fig. 6—Flow rate ratio for chilled jet

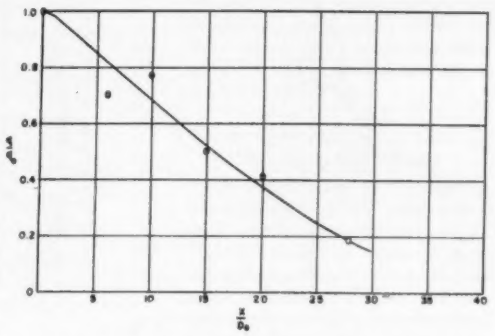

Fig. 7—Enthalpy-difference flow rate ratio for chilled jet

finding that the rate of turbulent heat transfer within the stream is greater than the rate of turbulent momentum transfer.

The cross-jet boundaries and profiles will be presented only in sample form.* Fig. 4 illustrates the velocity-magnitude and temperature-difference profiles taken across the jet in the vertical plane at a distance of 15 outlet diameters from the outlet. The velocities are those in the direction of the jet axis at the plane in question. Similar data, as well as velocity-direction profiles, were taken for each traverse plane.

Fig. 5 shows boundaries corresponding to Fig. 1 and 4. Establishing these boundaries in space required careful and extensive data. The axial data, the cross-profiles, and the boundaries comprised the basic information upon which calculations of jet quantities were based. In effect, these data give the velocity vector and the temperature difference for any position within the jet, — where the *jet* has been taken to be the region within the velocity boundary.

Jet Flow Rate

Fig. 6 shows the flow-rate ratio, where $W_0 = 7.36$ lb per min. The corresponding isothermal curve is given for comparison, and the difference between the two is a consequence of the differences in the velocity boundaries and in the velocity profiles, and also in the density fields, for W is a mass flow rate.

The sharp break at $x/D_0 > 28$ is a consequence of the jet striking the the floor. This increase in the flow is not properly understood at present, but it resides in the floor-layer movement of Fig. 2.

The present data did not go into the region of negative entrainment rates, but from Fig. 2 it appears that such would occur at greater distances from the outlet. The equation for W/W_0 is given in Appendix B.

Enthalpy-Difference Flow Rate

The difference in enthalpy between any cross-section of the jet stream and the surroundings is a measure of the cooling duty available at that section. Fig. 7 shows the enthalpy-difference flow rate for the present tests, with $q_0 = 69.5$ Btu per min.

The rapid falling off of the Btu per minute available for cooling at successive sections is striking. This illustrates the practical difficulty of achieving widely distributed cooling with but a single jet in a large space. A further application problem is that of spot cooling in hot industrial atmospheres, where long *throws* of a chilled jet would be relatively ineffective. The equation for q/q_0 is given in Appendix B.

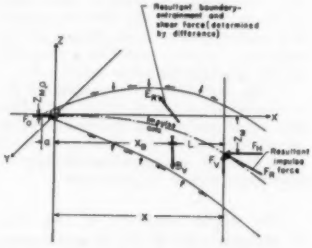

Fig. 8—Forces acting on a chilled jet

Forces Acting on the Chilled Jet

Consider as a fluid body the portion of the chilled jet bounded by the outlet plane, the velocity boundary surface, and a vertical plane at section x. The forces acting on this body are very real and need to be carefully appreciated. Fig. 8 shows these forces schematically,

where

F_0 = momentum impulse force at the outlet.
F_R = resultant momentum impulse force at plane x.
F_H, F_V = horizontal and vertical components of F_R, respectively.
B_V = buoyant force for the fluid body within the indicated envelope.
E_R = resultant unaccounted-for force, which comprises all effects which could not be established from direct data. Influences in E_R would be boundary shear, entrainment-impulse action, and any pressure differences prevailing.

The momentum impulse forces are shown in Fig. 9, where $F_0 = 0.0364$ lb. The force F_0 acts on the vertical diameter of the outlet at a distance $Z_{M,0} = 0.0111$ ft above the outlet center.

The buoyant force is given in Fig. 10, along with the location of its

*It is contemplated that tabular summaries of the data will be published later in a more complete report, perhaps a Research Bulletin. Pending such release, ASHVE members may obtain copies of the tabulated data by applying to the ASHVE Research Laboratory, 7218 Euclid Ave., Cleveland 3, Ohio.

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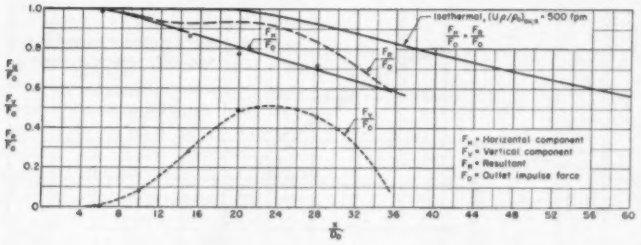

Fig. 9—Momentum impluse-force magnitudes for chilled jet

line of action. Since buoyancy depends upon the density of the surrounding fluid, these calculations were made for the temperature conditions noted in Fig. 10. The resultant unaccounted-for force is obtained from a force balance and is shown in Fig. 11.

The equations for the quantities involved are given in Appendix B. The small magnitude of these forces deserves repeated appreciation. An understanding of their action is believed to be an important key to the improved quantitative treatment of room air distribution.

Moments Acting on the Chilled Jet

The force system sketched in Fig. 8 also involves moments which act on the fluid body. These moments likewise must be in balance under steady-state conditions. To evaluate the moments, a convenient moment center is the point of action of the resultant momentum impulse force, F_R, in the vertical plane at position x. The following moments are involved, referring to Fig. 8:

F_0 $(Z_M - Z_{M,0})$, the moment of the outlet momentum impulse force, acting clockwise. (Measuring Z positive downward, $-Z_{M,0}$ is a positive quantity, since F_0 acts above the origin of coordinates in this case.)

$B_V L$, the moment of the buoyant force, acting counterclockwise.

M_E, the moment of the unaccounted-for forces, calculated from a moment balance as necessary for equilibrium.

Magnitudes of the moments acting for the prevailing test conditions are shown in Fig. 12. It is interesting to note that, in this instance, M_E is small enough so that it might be neglected for purposes of approximation. The small magnitude of M_E is explained by the fact that the forces which contribute to M_E are distributed about the entire jet-boundary envelope of Fig. 8, and there is a tendency to balance clockwise and counterclockwise actions.

The forces and moments presented have been those acting in a vertical plane. If the jet axis should be curved appreciably in the horizontal direction, another set of forces and moments would be involved.

Vertical Drop of the Jet Axis

The vertical drop of a horizontally-projected chilled jet is of outstanding practical importance. The results from this single exploratory run are inadequate to establish any general formulation for vertical drop, but the physical principles involved may be profitably examined.

The position of the jet axis, which is the line of maximum velocity and temperature difference, is taken to be of primary interest. In the present work, all boundaries and profiles have been referred to this axis.

Fig. 13 compares the jet axis with the impulse axis. The impulse axis is defined as the locus of the points of action of the momentum impulse force in successive vertical-plane sections through the jet. The jet axis is not susceptible to prediction in advance from the information on hand, whereas the position of the impulse axis may be established from the forces and moments acting.

The coordinate Z_M of the impulse axis is calculated from the expression given in Appendix B. An approximation to Z_M is obtainable by neglecting M_E and $Z_{M,0}$, both of which are relatively small. The approximate coordinate on this basis is

$$Z_M' = B_V L / F_0, \text{ ft} \quad \ldots\ldots\ldots\ldots (1)$$

where

B_V = buoyant force, from Appendix B, Equation B-7, pounds.

L = distance between vertical plane at x and line of action of B_V, from Appendix B, Equation B-13, feet.

F_0 = outlet impulse force, from Appendix B, Equation B-3, pounds.

From Fig. 13, the approximation of Z_M' is rather good for the present test conditions. Generalization of this result is not warranted, but a practical suggestion may be developed for future evaluation.

The variation of B_V and of L with x, noted in Fig. 10, is approximately linear. From this, Equation 1 suggests the empirical expression.

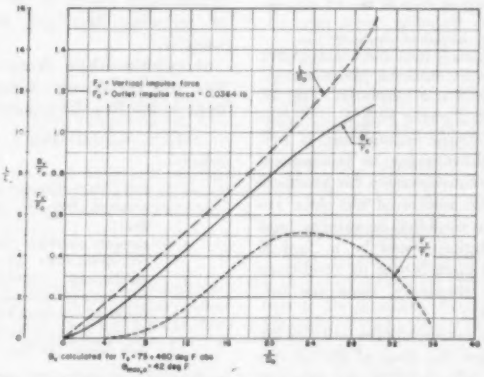

Fig. 10—Buoyant force B_V and distance L between line of action of B_V and vertical plane at x

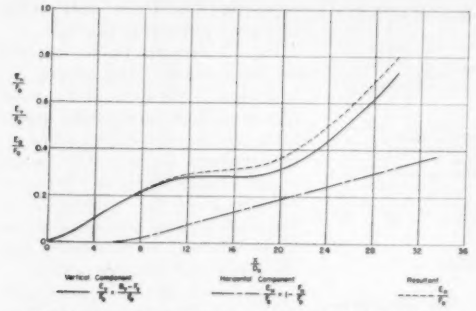

Fig. 11—Resultant unaccounted-for forces for chilled jet

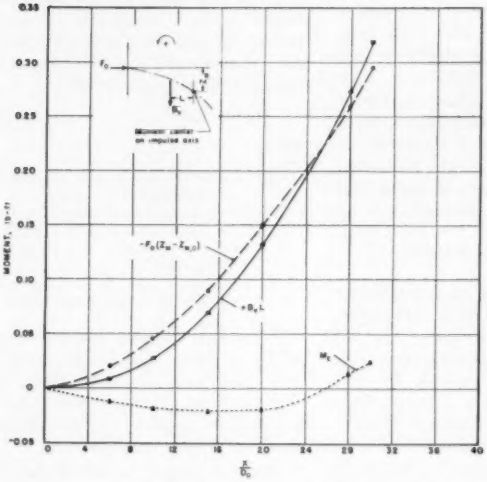

Fig. 12—Moments acting on chilled jet

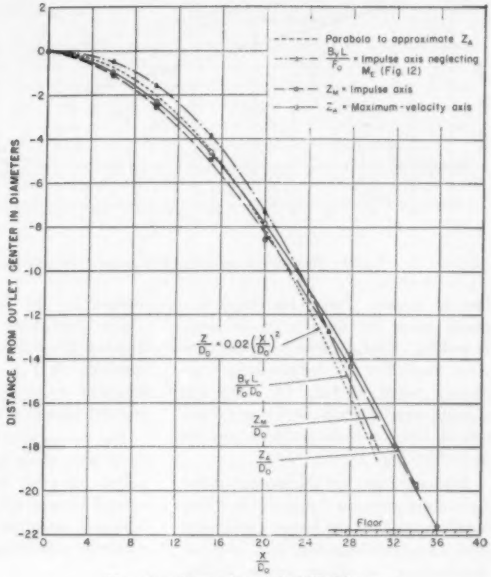

Fig. 13—Comparison of chilled-jet axes

$-F_0 (Z_M - Z_{M,0})$ = Outlet impulse-force moment
$B_V L$ = Buoyant-force moment
M_E = Resultant moment of shear and entrainment forces obtained by difference

$$Z_a = K\ (x/D_0)^2,\ \text{ft} \quad \ldots\ldots\ldots (2)$$

where

Z_a = parabolic approximation to the vertical drop of the jet axis below the outlet center, feet.
K = an empirical constant, feet.
x/D_0 = distance from outlet measured in outlet diameters, dimensionless.

Equation 2 is a parabola. Fig. 13 shows such a curve with $K = 0.020$ ft. This simple formulation is sufficiently encouraging to recommend its careful consideration for practical use. Many additional test data are required to establish its validity, and the expectation would be to find K dependent upon initial jet conditions and also, ultimately, upon the surroundings.

This discussion applies only to the range where the drop of the jet has not been influenced by the presence of the floor.

The Turbulent Prandtl Number

It is appropriate to recognize a fundamental aspect of the processes of turbulent heat and momentum transfer.

A quantity which characterizes the flow and heat-transfer behavior of a fluid is the Prandtl number,

$$N_{Pr} = (c_p \mu g/k)\ 3600 \quad \ldots\ldots\ldots (3)$$

where

c_p = unit heat capacity at constant pressure, Btu per (pound) (F deg).
μ = absolute viscosity, pound seconds per square foot.
g = gravitational constant, 32.2 feet per (second) (second).
k = thermal conductivity, Btu per (hour) (square foot) (Fahrenheit degree per foot).

For air at ordinary temperatures and pressures, $N_{Pr} = 0.71$. Discussion of the significance of N_{Pr} is beyond the scope of this paper; the details are covered in other references, for example, Jakob.[6]

A turbulence-empiricism counterpart of N_{Pr} is obtained by replacing the viscosity, μ, by the eddy viscosity, $\rho\epsilon$, and the thermal conductivity k, by the eddy conductivity, β. Thus, the turbulent Prandtl number is

$$N_{Pr,t} = (c_p \rho\ \epsilon/\beta)\ 3600 \quad \ldots\ldots\ldots (4)$$

where

ρ = density, pounds per cubic foot.
ϵ = eddy kinematic viscosity, defined as the ratio of the shear stress produced by turbulence to the local velocity gradient across the flow, square feet per second.
β = eddy conductivity, defined as the ratio of the unit-area heat transfer rate produced by turbulence to the local temperature gradient across the flow, Btu per (hour) (square foot) (Fahrenheit degree per foot).

The turbulent Prandtl number $N_{Pr,t}$ is very useful in analytical work. For instance, if the eddy vis-

cosity and $N_{Pr,t}$ are known, the eddy conductivity may be predicted. Thus, the temperature field may be predicted from the velocity field over the range where $N_{Pr,t}$ is known; and knowing the temperature field, estimates may be made of the buoyant force. The major uncertainty in analyses of this nature is the treatment of boundary conditions and the region of reverse flow, where experimental guidance is needed.

The meager data previously available for $N_{Pr,t}$ have been reviewed by Forstall and Shapiro,[7] with the very interesting result that, for practical utility,

$$N_{Pr} \cong N_{Pr,t} \quad \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Magnitudes of $N_{Pr,t}$ were calculated from the present data according to the relation —

$$N_{Pr,t} = \frac{d\left(\log_e \frac{\theta}{\theta_{max}}\right)}{d\left(\log_e \frac{S}{S_{max}}\right)} \quad \ldots\ldots\ldots\ldots\ldots\ldots (6)$$

where

θ = temperature difference between the jet and the surroundings, Fahrenheit degrees.

S = velocity in the direction of the jet axis, feet per minute.

The ratios (θ/θ_{max}) and (S/S_{max}) come from the cross-jet profiles of which Fig. 4 is a sample. Equation 6 gives an average magnitude of $N_{Pr,t}$ along a jet radius.

Fig. 14 shows an illustrative logarithmic plotting for determining $N_{Pr,t}$ and also gives the average results for all profiles. These results substantiate Equation 5 except at the farthest distance from the outlet. This is an important extension of the range of flow conditions for which Equation 5 may be used, for previous data all were for high velocities and heated flow.

This fundamental finding from this single exploratory run gives strong promise for rational advances in non-isothermal room air distribution.

Recommendation

It is recommended that continuing careful studies should be made for non-isothermal ventilation jets, in accord with the established objectives of the long-range research program.[2]

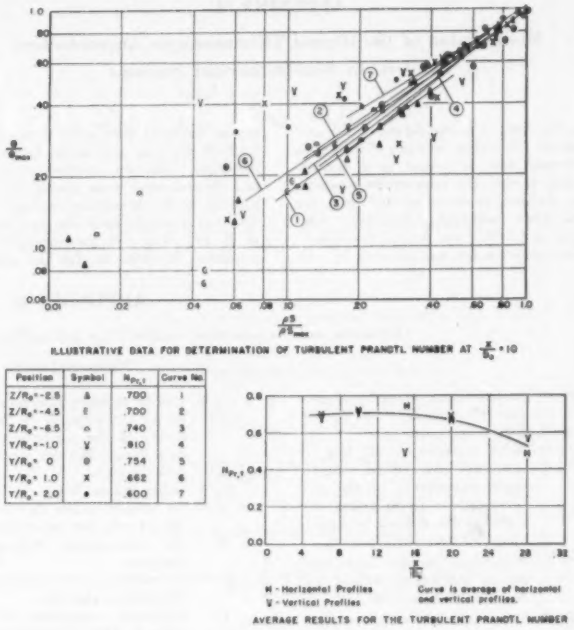
ILLUSTRATIVE DATA FOR DETERMINATION OF TURBULENT PRANDTL NUMBER AT
Position | Symbol | $N_{Pr,t}$ | Curve No.
Z/R₀ = -2.5 | Δ | .700 | 1
Z/R₀ = -4.5 | ◻ | .700 | 2
Z/R₀ = -6.5 | ○ | .740 | 3
Y/R₀ = -1.0 | ▽ | .810 | 4
Y/R₀ = 0 | ⊙ | .754 | 5
Y/R₀ = 1.0 | X | .662 | 6
Y/R₀ = 2.0 | • | .600 | 7
H - Horizontal Profiles
V - Vertical Profiles
Curve is average of horizontal and vertical profiles.
AVERAGE RESULTS FOR THE TURBULENT PRANDTL NUMBER

Fig. 14—The turbulent Prandtl number

Conclusions

The following conclusions may be drawn from these tests:

1. The temperature and velocity fields for a non-isothermal ventilation jet are markedly dissimilar.
2. Quantitative study of the forces and moments acting on a buoyant jet is believed to be a most promising method of investigation.
3. The vertical drop of a horizontally-projected chilled jet appears to be expressible by a simple parabolic formula containing a single empirical factor to be related to the independent variables of the system.
4. Of fundamental significance, the turbulent Prandtl number has been found very nearly equal to the conventional Prandtl number.

References

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2. Isothermal Ventilation-Jet Fundamentals, by H. B. Nottage, J. G. Slaby and W. P. Gojsza (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, January 1952).

3. A Smoke-Filament Technique for Research in Room Air Distribution, by H. B. Nottage, J. G. Slaby and W. P. Gojsza (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, July 1952).

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5. A Simple Heated-Thermocouple Anemometer, by H. B. Nottage (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, September 1950, p. 146).

6. *Heat Transfer*, by M. Jakob (John Wiley and Sons, Inc., New York, 1949).

7. Momentum and Mass Transfer in Coaxial Gas Jets, by W. Forstall, Jr. and A. H. Shapiro (*Journal of Applied Mechanics*, December 1950, p. 394).

Acknowledgment

This paper is based upon part of a thesis submitted by the senior author to the Graduate Faculty of Case Institute of Technology; the guidance of Professors G. L. Tuve, S. D. Black and L. G. Seigel is gratefully acknowledged.

APPENDIX A

Modification of the Heated Thermocouple Anemometers for Use in Non-Isothermal Streams

If the form of heated-thermocouple anemometer[5] developed initially for use in isothermal flow is placed in a non-isothermal stream, the cross-stream temperature gradient produces an emf with the anemometer unheated. Automatic compensation for this was judged desirable.

The compensation was achieved by adding an unheated differential thermocouple, made of the same wire as the heated thermocouple. The two junctions of this second thermocouple were placed in a line parallel to the heated-thermocouple junctions but separated therefrom by a distance of ½ in. The two thermocouples were connected in series so that the algebraic difference between the respective emf magnitudes was obtained.

The performance of this compensating arrangement was checked for each profile by making an initial traverse with the anemometer unheated. Perfect performance would give zero net emf. This was obtained in the majority of positions, but at $x/D_O < 10$ the local jet temperature gradients were sufficiently steep so that a small net reading generally was encountered. This however was not serious, and the final data merely were corrected by the amount of the net uncompensated emf at each such position.

APPENDIX B

(Equations and Nomenclature employed for the analyses presented in the paper.)

Nomenclature

B_V = buoyant force, given by Equation B-7, pounds.
d = differential operator.
D_O = outlet diameter = 0.5 feet.
E_H, E_V = horizontal and vertical components, respectively, of the unaccounted-for forces acting on a chilled jet, defined by Equations B-9 and B-10, pounds.
F_O = momentum impulse force acting at the outlet, defined by Equation B-3, pounds.
F_H, F_V = horizontal and vertical components, respectively, of the momentum impulse force acting on a vertical plane section through the jet, defined by Equations B-4 and B-5, pounds.
F_R = resultant of F_H and F_V, pounds.
L = distance between vertical plane at coordinate position x and the line of action of B_V, as sketched in Fig. 8, feet.
M_R = resultant unaccounted-for moment acting on the chilled jet, defined by Equation B-14, pound feet.
q = rate of enthalpy-difference flow in the jet, referring to the enthalpy of the surrounding air as a datum, Btu per minute.
q_O = q at the outlet.
R_O = outlet radius, feet.
S = jet velocity in the direction of the jet axis, feet per minute.
T = jet temperature, Fahrenheit, absolute.
T_s = surrounding air temperature, Fahrenheit, absolute.
U = horizontal component of jet velocity, feet per minute.
V = vertical component of jet velocity, feet per minute.
W = flow rate in jet, defined by Equation B-1, pounds per minute.
W_O = W at the jet outlet.
x,y,z = coordinate dimensions, referred to the center of the jet outlet as the origin, feet. x is the horizontal coordinate in the direction of the outlet axis, y is the horizontal coordinate in the direction perpendicular to x, and z is the vertical coordinate.
Z_a = parabolic approximation to vertical coordinate of jet axis, given by Equation 2, feet.
Z_M = vertical coordinate to the point of action of F_R, defined by Equation B-11, feet.
$Z_{M,O}$ = vertical coordinate to the point of action of F_O, defined by Equation B-12, feet.
ρ = jet density, pounds per cubic foot.
standard air density, 0.075 lb per cu ft.
ρ_s = surrounding air density, lb per cu ft.
θ = $T_s - T$, Fahrenheit degrees.
$\int$ denotes definite integral within the limits of the jet boundary at the vertical plane in question.
Subscripts min, max denote minimum and maximum magnitudes respectively. Subscripts o,x denote vertical planes at the outlet and at coordinate distance x respectively.

Equations

The Jet Flow Rate

$$\frac{W}{W_O} = \frac{(\rho U)_{max,O}}{(\rho U)_{av,O}} \frac{(\rho S)_{max,x}}{(\rho S)_{max,O}} \frac{1}{\pi} \int_0^1 \int_{jet} \int_{jet} d\left(\frac{(\rho U)}{(\rho S)_{max,x}}\right) d\left(\frac{y}{R_O}\right) d\left(\frac{z}{R_O}\right) \quad \text{(B-1)}$$

The Enthalpy-Difference Flow Rate

$$\frac{q}{q_O} = \frac{(\rho S)_{max,x}}{(\rho S)_{max,O}} \frac{\theta_{max,x}}{\theta_{max,O}} \frac{\left[\int_0^1 \int_{jet} \int_{jet} d\left(\frac{\rho U}{(\rho S)_{max,x}} \frac{\theta}{\theta_{max,x}}\right) d\left(\frac{y}{R_O}\right) d\left(\frac{z}{R_O}\right)\right]_x}{\left[\int_0^1 \int_{jet} \int_{jet} d\left(\frac{\rho U}{(\rho S)_{max,x}} \frac{\theta}{\theta_{max,x}}\right) d\left(\frac{y}{R_O}\right) d\left(\frac{z}{R_O}\right)\right]_{x=O}} \quad \text{(B-2)}$$

Forces Acting on the Chilled Jet

Outlet momentum impulse force

$$F_O = \int_{jet} \int_{jet} \rho U^2 \, dy \, dz \quad \text{(B-3)}$$

where

ρ, U, and the limits of y and z refer to the outlet.

Horizontal component of the momentum impulse force

$$\frac{F_H}{F_0} = \frac{(U\rho/\rho_a)^2_{max,o}}{\left[\frac{1}{\rho/\rho_a}(U\rho/\rho_a)^2\right]_{mean,o}} \frac{(\rho S)^2_{max,x}}{(\rho S)^2_{max,o}} \frac{1}{\pi} \int_0^1 \int_{jet} \int_{jet} d\left(\frac{1}{\rho/\rho_a} \frac{(\rho U)^2}{(\rho S)^2_{max,x}}\right) d\left(\frac{y}{R_0}\right) d\left(\frac{z}{R_0}\right) \quad \text{(B-4)}$$

Vertical component of the momentum impulse force

$$\frac{F_V}{F_0} = \frac{(U\rho/\rho_a)^2_{max,o}}{\left[\frac{1}{\rho/\rho_a}(U\rho/\rho_a)^2\right]_{mean,o}} \frac{(\rho S)^2_{max,x}}{(\rho S)^2_{max,o}} \frac{1}{\pi} \int_0^1 \int_{jet} \int_{jet} d\left(\frac{1}{\rho/\rho_a} \frac{(\rho V)^2}{(\rho S)^2_{max,x}}\right) d\left(\frac{y}{R_0}\right) d\left(\frac{z}{R_0}\right) \quad \text{(B-5)}$$

Resultant momentum impulse force

$$\frac{F_R}{F_0} = \sqrt{\left(\frac{F_H}{F_0}\right)^2 + \left(\frac{F_V}{F_0}\right)^2} \quad \text{(B-6)}$$

Buoyant force

$$B_V = \int_0^1 \int_{jet} \int_{jet} (\rho - \rho_a)\, dx\, dy\, dz \quad \text{(B-7)}$$

where

$$(\rho - \rho_a) = (\rho_{max} - \rho_a)_0 \frac{\theta_{max,x}}{\theta_{max,o}} \frac{T_{min,o}}{T_{min,x}} \left(\frac{T_a - \theta_{max}}{T_a - \theta}\right)_x \left(\frac{\theta}{\theta_{max}}\right)_x \quad \text{(B-8)}$$

Resultant unaccounted-for force

$$\frac{E_H}{F_0} = \frac{F_0 - F_H}{F_0} \quad \text{(B-9)}$$

$$\frac{E_V}{F_0} = \frac{B_V - F_V}{F_0} \quad \text{(B-10)}$$

Moments Acting on the Chilled Jet

Moment of the outlet impulse force is $F_0\ (Z_M - Z_{M,0})$

Vertical coordinate of the impulse axis is

$$z_M = \frac{1}{F_H} \int_{jet} \int_{jet} z\, \rho\, U^2\, dy\, dz \quad \text{(B-11)}$$

$$z_{M,0} = \frac{1}{F_0} \int_{jet} \int_{jet} z\, \rho\, U^2\, dy\, dz \quad \text{(B-12)}$$

Moment of the buoyant force is $B_V L$

$$L = x - \frac{1}{B_V} \int_0^1 x \left[\int_{jet} \int_{jet} (\rho - \rho_a)\, dy\, dz\right] dx \quad \text{(B-13)}$$

Resultant unaccounted-for moment

$$M_E = B_V L - F_0(z_M - z_{M,0}) \quad \text{(B-14)}$$

REVISION OF COMFORT CODE

The Code of Minimum Requirements for Comfort Air Conditioning, which was adopted by the Society in 1938, will be revised by a Joint Committee having representatives from ASHVE, *ASRE*, *ASME*, *ACRMA* and the medical profession. W. L. Fleisher is chairman of the committee which at present has the following members: (ASHVE) O. W. Armspach, A. C. Buensod, C. C. Cheyney; (*ASME*) Carl F. Kayan; (*ASRE*) F. H. Faust, Vincent Gessel, J. A. Schurman; (Medical Profession) E. F. DuBois, M.D., R. W. Keeton, M.D., W. J. McConnell, M.D.

The first meeting of the committee was held June 17, during the ASHVE Semi-Annual Meeting at Spring Lake, N. J. The committee will undertake a major revision of the code in order to take into account the advances that have been made in air conditioning since 1938 and the changes that have been made in habits of people with regard to living conditions and quantity of clothing worn. The increased use of large glass areas in buildings and the application of panel heating have introduced factors which must be considered in establishing the comfort conditions specified in the code.

Personal Notes

E. R. QUEER, State College, Pa., professor of engineering research and assistant director of the Engineering Experiment Station at the Pennsylvania State College, has been appointed director of the Department of Engineering Research, effective September 1. The name of the department will also be changed to more clearly convey its research and development functions rather than its testing, of which it does very little today.

Professor Queer, a member of the Society since 1933, is a member of the Council and has served on several Technical Advisory Committees. He is also a member of several naval, architectural, and engineering societies.

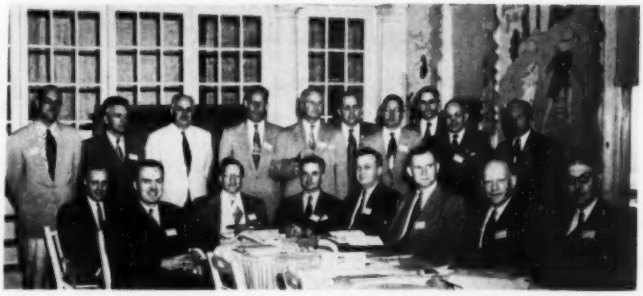
HERWART WERKER, Louisville, Ky., formerly manager of the Heating Division of the Research Department of American Radiator and Standard Sanitary Corp. and a member of the Society since 1939, was recently promoted to director of research of the corporation. In his new job he will direct all plumbing, heating and air conditioning research conducted by the firm.

Semi-Annual Meeting

THE SOCIETY'S 1952 Semi-Annual Meeting, with New York Chapter as host, was conducted under the auspices of a special Committee on Arrangements consisting generally of members living in New Jersey. F. H. Faust, Bloomfield, N.J., was chairman of the committee.

A total of 476 members, guests and ladies, who came from 29 states and two provinces of Canada, enjoyed the opportunity to relax and renew acquaintances in the spacious hotel lobbies of The Essex and Sussex, or on the ocean boardwalk and beach.

Members arriving on Saturday, or at any time during the meeting, found that the committee had everything in readiness for prompt handling of room assignments, meeting information, and registration for special events.



Officers and members of Council at meeting in Spring Lake
Seated (*l. to r.*) A. V. Hutchinson, L. N. Hunter, Ernest Szekely, E. R. Queer, L. E. Seeley, G. B. Supple, J. Donald Kroeker, Reg F. Taylor. Standing (*l. to r.*) J. E. Haines, B. H. Spurlock, Jr., P. B. Gordon, B. L. Evans, N. H. Peterson, R. T. Kern, D. M. Mills, J. W. James, M. K. Fahnestock, J. H. Fox

FIRST SESSION, MONDAY JUNE 16, 9:30 A.M.

Pres. Ernest Szekely, Milwaukee, called the meeting to order in the ballroom of The Essex and Sussex. He called on P. B. Gordon, president of New York Chapter, who welcomed the members and guests, and then introduced F. H. Faust, who summarized the entertainment features of the three-day program.

President Szekely, speaking for the Officers and Council of the Society, expressed appreciation of the cordial welcome received and the careful preparations made by the committee for the reception of those attending.

The following Committee on Resolutions was appointed: G. W. F. Myers, St. Louis, *chairman;* G. W. Bornquist, Chicago; D. M. Mills, Houston.

After reading the rules for professional sessions, President Szekely introduced W. E. Emley, Jr., Cleveland, who presented an abstract of his paper, Experimental Data on Drying Atmospheric Air for a Supersonic Wind Tunnel (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, July 1952).

JOHN EVERETTS, JR., Philadelphia, asked whether any comparison had been made of the methods of reactivating the desiccants, and whether any information was available on reactivation temperatures and their effect.

H. E. ZIEL, Detroit, inquired whether consideration had been given to the load imposed by inward vapor leakage into a tunnel, and whether it would be advantageous to recirculate the air or to have partial recirculation of air in the tunnel instead of using outside air.

In the author's closure, Mr. Emley said that several air drying installations using both silica gel and activated alumina have been in operation for as long as seven years at the Lewis Flight Propulsion Laboratory, and comparable installations are to be found in other laboratories. For either desiccant, the minimum safe reactivation temperature required to obtain the necessary low dew-point was approximately 320 to 330 F. Equipment at the Laboratory was designed so that supply reactivation air would be 375 to 400 F if possible. The high reactivation temperature was made necessary by the requirement of a low dew-point.

Replying to Mr. Ziel's question, the author stated that recirculation was employed in tunnels where the air stream circulated over a model. In propulsion tunnels, however, the continual addition of the products of combustion to the circulated air made it necessary to use 100 percent outside air for air supply.

The second technical paper, A Low-Inertia Low-Resistance Heat Flow Meter, by R. G. Huebscher, L. F. Schutrum and G. V. Parmelee of Cleveland (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, May 1952) was presented in abstract by Mr. Huebscher.

F. C. HOOPER, Toronto (WRITTEN): The heat meter described appears to be a definite advance over previously available devices, particularly with respect to its stability of calibration and uniformity of response. The authors are to be commended for their careful work and valuable contributions.

One or two points with respect to the manner of correction for thermal resistance come to mind. The surface emissivity of the meter may be quite important in some instances, particularly in application to low resistance walls. The effective resistance of the meter may, because of its aluminum surface, be considerably higher than the thermal conductance values quoted would indicate. Suitable painting of the meter would be a simple means of correction in most cases. Unless such a precaution were taken the second method of correction, suggested in Equation 2, could be seriously in error.

L. V. TEESDALE, Milwaukee (WRITTEN): The meter described appears to be well suited for determining the thermal properties of built-up construction. The even distribution of the thermocouples over the entire area of the meter appears to be a very good feature of this design. The 16-in. size should be particularly well adapted for stud walls since it would take

Spring Lake, N. J.

Members of Committee on Research in session at Spring Lake
Seated (*l. to r.*) I. W. Cotton, Miss Ilse Jahn, R. S. Dill, W. N. Witheridge, T. H. Smoot, Dr. R. W. Keeton. Standing (*l. to r.*) H. A. Lockhart, R. C. Cross, A. B. Algren, N. B. Hutcheon, C. O. Mackey, C. F. Boester, W. A. Grant, B. H. Jennings, John Everetts, Jr., A. J. Hess, Cyril Tasker

in both the stud and the space between studs in one setting. Smaller surface meters do not have this advantage.

Our experience with surface-type meters is limited to one type having a 4- × 4-in. face. If our work required a surface-type meter, we would prefer one with a larger face.

P. R. ACHENBACH, Washington, D. C., commended the ASHVE Laboratory for making the details of construction of the new meter available to everyone. He felt that the meter would have many applications in the heating field, and that it might be useful in evaluating the radiation component of heat transfer from the human body to the surrounding walls of a room under various conditions.

A group of such meters connected in series and located in one or more panels around the walls of a room would show an increase in output directly related to the radiation of an occupant to the surroundings.

C. B. BRADLEY, Manville, N. J., mentioned the possibility of using heat flow meters for rapidly obtaining heat flow data for statistical analysis. He believed that the meters described in the paper would be more suitable than any meter presently available for the purpose.

In the authors' closure, Mr. Huebscher stated that a great deal of experience obtained with the meters had not been included in the paper due to lack of space. Anyone interested may obtain further information by writing to the Research Laboratory.

The third technical paper, Effectiveness and Temperature Requirements for Cooling Panels Removing Internal Radiation, by Merl Baker, Lexington, Ky. (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, June 1952) was presented by the author.

H. E. ZIEL asked what recommendation the author would have for use of cooling panels in a normal auditorium where the outside prevailing wet-bulb temperature was 76 F. He also inquired whether all air conditioning would be accomplished from a central system, or whether some cooling panels would be recommended.

C. S. LEOPOLD, Philadelphia, remarked that cooling panels would not be of practical value in auditoriums because the latent heat load would be too high. Consequently the quantity of air required to take care of the latent load pickup would accomplish a large part of the necessary cooling.

Cooling panels under a balcony might, however, improve comfort of people sitting close together, but the cost would not be in proportion to the advantage gained.

The application of panel cooling, up to now, has been made mostly in multi-story structures, largely because such an installation uses a minimum of floor space and volume for the air conditioning system. The imbedment of tubes in plaster cooling panels is not desirable because the temperature gradient necessary to produce a cool surface is too great. Suspended ceilings of metal have therefore been used as cooling panels. The top of the panel in this case does not cool the room, but does cool the floor above it. In the case of vented recessed fluorescent type lighting fixtures, the ballast heat is, to a large extent, delivered above the ceiling where it is extracted by the top of the panel. A considerable portion of the heat and temperature rise due to the warm reflector is picked up by the upper air and transferred to the panel.

Mr. Leopold spoke of his previous tests in which panel cooling tubes had been placed on the reflecting surface of a fluorescent fixture and had thereby removed practically all of the initial energy input of the fluorescent fixture.

Mr. Leopold pointed out that partitions and heavy floors store a considerable amount of heat, and thereby exert an averaging effect particularly with regard to sun effect. This averaging effect must be considered in determining cooling load.

In the author's closure, Dr. Baker recognized that for some applications panel cooling may not be applicable, but emphasized that in certain cases the panels may have outstanding advantages in removing heat that might otherwise need to be removed entirely by chilled air. Panel cooling is an important means of removing energy from an enclosure and should therefore be considered for nearly every cooling installation.

President Szekely thanked the authors of the papers presented, and adjourned the meeting at 11:30 a.m.

SECOND SESSION, TUESDAY, JUNE 17, 9:30 A.M.

Pres. Ernest Szekely called the second technical session to order at 9:30 a.m. and asked First Vice Pres. Reg F. Taylor, Houston, to preside.

Mr. Taylor read the rules for technical sessions and then called on Dr. N. B. Hutcheon, Ottawa, who presented an abstract of the first paper, Moisture Migration in a Closed Guarded Hot Plate, by N. B. Hutcheon and J. A. Paxton, Saskatoon, Canada, (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, April 1952).

L. V. TEESDALE (WRITTEN): This paper corroborates the efforts of many others who have done work in this field of investigation covering various materials. It emphasizes the importance of recognizing the effect that any moisture present in test material may have on the results obtained by the hot-plate method of test.

Such information is of direct value to those working with a hot plate but is of indirect value also to the engineer who is using insulation to prevent condensation in a wall or roof. Since this paper explains how moisture migrates and collects on the cold side of the unit, it explains the movement of moisture that may take place in a construction unit. In one case, the moisture is limited to that present in the test material at the time it is enclosed in the hot plate, but, in the other case, moisture in the atmosphere on the warm side enters the construction unit and is not so limited, unless there is a vapor barrier on the warm side.

CARL F. KAYAN, New York City, asked the authors to make further comment on the difference in results with sample in vertical or horizontal position.

Dr. Hutcheon in the authors' closure stated that, at high moisture contents, water ran freely through the sample when it was held in a vertical position. This prevented testing under these conditions.

In attempting to assess the effect of free movement of water by gravity, two cells were tested in horizontal position, one with hot side on top and one with cold side on top. The cells were then reversed in position, but the heat meters showed no difference in heat flow.

Referring back to Fig. 13, the author pointed out the possibility that when using an insulating material having a good *wicking* action and thereby obtaining a sufficient return of moisture from the cold side, it might be possible to carry a vapor pressure on the warm side higher than usually considered safe, provided the cold side did not fall below 32 F.

The second technical paper, Cooling Load from Sunlit Glass, by C. O. Mackey and N. R. Gay (see p. 117) was presented by Professor Gay.

C. M. ASHLEY, Syracuse, N. Y., referred to the paper as an excellent beginning in studying cooling load. He felt that ability to solve the problem of cooling load by means of the analogue would depend on ability to investigate other factors which affect the load. Some of these complicating factors are the variation in amount of radiation received by different parts of different surfaces of the rooms, the effect of furnishings having low heat storage and which may absorb radiation passing from one wall to another or coming directly from the outside, and the absorption of radiation by the air at relatively high humidity. Mr. Ashley asked how these factors could be included in the study.

In the authors' closure, Professor Gay said that while some of the assumptions made to simplify the study were unreal but necessary in order to obtain a start on the problem, it was felt that additional storage tubes and loops could be added to simulate effect of the complicating factors.

Professor Gay stated that correction of convective conductance values would require a separate study.

The third technical paper, A Study of a Transient Heat Method for Measuring Thermal Conductivity, by D. D'Eustachio and R. E. Schreiner, Port Allegany, Pa. (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, June 1952) was presented in abstract by Dr. D'Eustachio.

F. C. HOOPER, and E. A. ALLCUT, Toronto (WRITTEN): The careful work reported in this paper is an interesting and valuable contribution to the literature on the thermal conductivity probe type of instrument which is now coming into use in field and laboratory applications.

The line of development taken is somewhat different from that which we have followed at Toronto since publication of our 1950 paper*. Our further work is now in process of publication. The basic criterion of Dr. D'Eustachio and Mr. Schreiner, that the temperature rise in the material under test should be as small as possible, has led directly to the development of the very small probe described, and to the conclusion that a still smaller probe is desirable. This dictation of the physical size of the instrument would severely limit its field of application, and the premise should be carefully examined. Moreover, construction of the small probe requires considerable skill and careful workmanship, and the correspondingly small significant time interval demands sensitive laboratory temperature measurement instrumentation. The use of this probe in field and factory applications, where to date probes have found their widest application, would be inhibited.

Physically small probes are necessary in some special applications, such as in liquids where convection is a critical factor, and we have ourselves built several at Toronto, but there appears to be no direct inference that, of itself, small size offers higher absolute accuracy.

Limiting the temperature rise will, of course, limit the effect of the temperature coefficient of thermal conductivity, but this factor is demonstrably negligible for temperature rises of less than about 25 F deg at the probe wall. If this factor be omitted, then the accuracy of conductivity determination appears to be quite independent of the absolute probe dimensions. Moreover, larger physical sizes of probes have correspondingly larger and more easily measured times, temperatures and heat inputs.

Errors due to longitudinal conduction, non-radial heat flow, thermal capacity, and probe non-homogeneity, all appear to be functions of dimension ratios, such as length to diameter, and specific heat of specimen to specific heat of probe material. Thus, providing that times, temperature rises, and heat inputs have been altered in suitable ratio to size, and conservatively assuming that the percentage accuracy of measurement of the larger quantities is only as good as that for the smaller quantities, it appears that the magnitude of these errors is independent of the dimension scale. We suggest that the need for correction for the above mentioned errors did not become apparent in this investigation because of the difficulties in making small differentiations in the already very small absolute values measured in the experiments reported.

We do not understand the significance of the discussion in the last paragraph of temperature gradients in the insulation at the probe surface. With the ideal line source the gradient at the line will always be infinite, and if for some reason it was desired to decrease this gradient, then increasing the diameter, not decreasing it, would most directly accomplish this.

The remarkable absence of significant effects due to poor contact between the probe and boundary material reported coincides with our own experience, as does the close agreement between hot plate and probe determinations.

F. A. JOY, State College, Pa. (WRITTEN): The transient method of conductivity measurement is as logical as it is convenient and the authors have made notable progress toward their idealized goal — the *vanishing point* of probe dimensions. In their commendable desire for a measurement that is absolute, they are concerned about: (1) the heat capacity of the probe; (2) heat flow along the probe; (3) non-radial heat flow in the material tested. These effects will be reduced in the modifications proposed, but their elimination is suggested in other possible approaches.

Would it be feasible to include a cooling phase in the technique, providing both temperature rise and subsequent fall with $\theta_2 = \theta_1$, thus eliminating heat storage in the probe? Is it feasible to *guard* the middle portion of the probe against end loss by providing more heat at its ends, that is, by increasing the heating element resistance at these points? Would this arrangement provide some correction to non-radial flow?

These questions are easier perhaps than their answers. If not already fully considered, they may contribute to the further progress of this most promising development, in which the authors are to be commended for their outstanding work.

R. B. CREPPS, Newark, Ohio (WRITTEN): The work reported by the authors in developing the heated probe method for determining thermal conductivity is indeed interesting and opens up fields for ex-

*Transient Heat Flow Apparatus for the Determination of Thermal Conductivities, by F. C. Hooper and F. R. Lepper (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, August 1950).

ploration for thermal measurement at considerably lower cost than possible by standardized equipment. Particularly is this so for the extremely low mean temperatures.

The authors have used materials in their evaluation which have isotropic properties and, therefore, the heat flow from the probe is approximately uniform in all directions. Many insulating materials, particularly of fibrous nature, do not have the isotropic properties and some may have as much as twice the heat flow in one direction as they have at 90 deg therefrom. In other words, the orientation of fibers within batts, or boards, plays a very important part in the correlation of Probe *vs* Hot Plate evaluation. This situation would be particularly enhanced when probe measurements would be attempted on thin fibrous materials of low unit weight.

N. B. HUTCHEON, Ottawa (WRITTEN): The authors are to be highly commended for the refinement achieved in the design and construction of a probe of such small diameter. They have also succeeded in obtaining remarkable correlation of results for cellular glass with those of the hot plate.

I would like to ask if they have tried out the probe on fibrous materials in batt, blanket or board form in which the fibers are oriented in planes parallel to the surface. It has been shown that the conductivity parallel to flax and mineral wool fibers is twice that measured in a direction at right angles. In a hot plate test of batts, blankets or boards of fibrous material the flow of heat takes place normal to the plane of the sample as it usually does in use. The flow of heat from a line heat source placed in such material is radially outward from the source, and will not be presented with the same average fiber orientation in its path. It is to be expected that heat flow from a probe thrust at right angles through a batt will encounter fibers preferentially oriented in the radial direction and that a higher value of the conductivity will be found. On this basis it would appear that the use of the probe to obtain absolute results may be restricted to materials possessing equal conductivity in all directions.

The authors suggest that because of the small temperature rise and short testing time, the probe will be useful in studying the effect of moisture on thermal conductivity.

The results just reported in the paper, Moisture Migration in a Closed Guarded Hot Plate, by N. B. Hutcheon and J. A. Paxton, indicate that in many insulating materials a substantial proportion of heat may be transferred as latent heat in the migrating vapor. It is not obvious that reducing either the temperature rise or time of testing will eliminate this effect. The results obtained from moist insulating materials which are also vapor-permeable may be specific to the conditions of test and therefore limited in usefulness. It should be very interesting to explore this possibility with the probe.

C. B. BRADLEY complimented the authors on their ingenuity in developing the mechanical and electrical features of the probe. He felt that the probe would be very useful for obtaining heat transfer data for statistical analysis in cases where the hot plate method is too slow.

Mr. Bradley asked the author how the proper time interval between θ_1 and θ_2 was established at a suitable value.

In the authors' closure, Dr. D'Eustachio stated, with reference to the discussion of Hooper and Allcut, that the probe was designed primarily as a laboratory instrument equivalent to the hot plate, and further that it was made to cover other applications such as determination of conductivity at —300 F, or determining the conductivity under vacuum conditions. The equipment for the low temperature test is a small Dewar flask and some liquid nitrogen. The equipment for the vacuum test is a bell jar, a steel plate, and a high vacuum pump.

Dr. D'Eustachio said that desired precision could readily be obtained with constantan thermocouples which could be used for measuring 1/100 F deg temperature difference. Commercially available amplifiers can be used to obtain measurements to 1/1000 F deg.

In tests to determine departure from radial heat flow, it was found that the measurements were within 1 percent error.

No practical probe can be an ideal line source. It will always have a finite diameter for which the temperature gradient at the surface is a function of the heat input to the probe and time. To obtain a smaller temperature gradient it is desirable to decrease the heat capacity by using fiber glass reinforcement instead of stainless steel casing on the probe.

Guards at the ends of the probe have been tried, but adjustment of the heat flow to the guards proved to be too difficult to be practicable.

While the instrument described was made as shown for a specific purpose, it can be made in many different ways. In one case a 2 mil constantan wire 18 in. long was stretched through a block of insulation to serve as a small diameter probe.

Dr. D'Eustachio said that in fibrous insulation the fibers were usually oriented in two dimensions, and consequently tests made with the probe perpendicular and then parallel to the fibers would be sufficient to establish the heat flow through the material.

The probe was first designed for use in moist materials where moisture migration is a problem. Plans have been made for tests with dry samples and with samples having fixed amounts of moisture in the hope that the effects of temperature gradient and temperature difference may be determined and that the moisture migration effect may be separated from the true conductivity effects.

With reference to the establishment of the time interval for Equation 2, Dr. D'Eustachio pointed out that when the logarithm of time is plotted *vs* temperature difference on semi-log paper, it will be evident that the time interval should be chosen to fit the straight section of the line. For the present instrument, time intervals of 1 min and 10 min have been found convenient. The time interval should be as large as practicable, but not long enough to encounter the effect of departure from radial flow.

First Vice President Taylor thanked the authors for their presentations and adjourned the meeting at 12 noon.

THIRD SESSION, WEDNESDAY, JUNE 18, 9:30 A.M.

Pres. Ernest Szekely called the third technical session to order at 9:30 a.m. and requested Second Vice Pres. L. N. Hunter, Johnstown, Pa., to preside at the session.

Mr. Hunter called on I. W. Cotton, Indianapolis, chairman of the Committee on Research, who gave a resume of the status of ASHVE research.

Mr. Cotton began his report by stating that many items of progress in research had been considered and acted upon during the Spring Lake Meeting.

He paid tribute to H. B. Nottage, Cleveland, who had recently obtained his Ph.D. degree from Case Institute of Technology, for his valuable contributions to Society research during the past seven years. It was announced with regret that Dr. Nottage was accepting a research position in California and would leave the Research Laboratory.

Mr. Cotton reviewed briefly the research in solar radiation and shading effect conducted under the supervision of G. V. Parmelee and the guidance of the TAC on Heat Flow Through Glass. Mr. Parmelee was given great credit for the successful conduct of this phase of Society research. A paper, The Shading of Sunlit Glass, to be presented at this session, was another report in the progress of this research.

The Operational Guide of the Committee on Research, now ready for Council approval, was cited as a

means of bringing new significance to the Technical Advisory Committees. The committees are now more representative of all Society interests and are proceeding with their outlined work with renewed vigor.

The work of the Technical Advisory Committees as well as that of the Committee on Research has been facilitated by instituting a report system providing these committees with up-to-the-minute reports on the status and cost of research projects. These reports were given to committee members over one week in advance of the meeting, and enabled all committees to shorten the time required to consider committee business.

Mr. Cotton referred briefly to: (1) the use which will be made of the facilities for comfort studies made available by the new environment laboratory; (2) the Navy Calorimeter project which will be extended following successful completion of the human calorimeter built at the laboratory; (3) the arrangements for starting the work on odor research in two special test rooms, using the subjects trained in odor perception.

Second Vice President Hunter called on P. B. Gordon, president of New York Chapter, for an announcement.

Mr. Gordon said that last April the Board of Governors reviewed the financial status of New York Chapter with regard to the possibility of making a contribution to Society research. It was felt that a check in the amount of $1000 contributed to Society research would do the most good for the members of New York Chapter. By unanimous action, the Chapter approved this recommendation.

Mr. Gordon stated that the New York Chapter members recognize that a thousand dollars in a budget of $180,000 is not a significant or sizeable percentage, but they want it to be a token or indication of their feeling and thinking regarding the value of Society research to the activities of the Society members and to the public.

Ernst Graber, who was president of the Chapter when the action was taken, then presented a check for $1000 to the general research fund.

Mr. Cotton expressed the appreciation of the Committee on Research not only for the contribution but also for the expression of confidence which accompanied the check.

Second Vice President Hunter read the rules for professional sessions and called on J. G. Slaby who presented an abstract of the paper, Outlet Turbulence Intensity as a Factor in Isothermal-Jet Flow, by H. B. Nottage, J. G. Slaby, and W. P. Gojsza, Cleveland (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, May 1952).

S. F. GILMAN, Urbana, Ill. (WRITTEN): This is an interesting investigation of outlet turbulence intensity using a Schubauer type of turbulence indicator. The paper states that the companion characteristic for describing a state of turbulence is the scale of turbulence, but that data on scale were beyond the exploratory interest at the time. However, on the basis of test results with his turbulence indicator, Schubauer reasoned that his indicator did not differentiate between different scales of turbulence. This subject was to be investigated by the Bureau of Standards, but I have seen no further report. If the Schubauer indicator does not differentiate between different scales of turbulence, the question arises as to whether the test results presented in Fig. 4 also include an undetermined effect of scale.

It is interesting to note that single and multiple grids of various percentages of open area when located at the nozzle entrance produced an insufficient increase in outlet turbulence intensity, and were therefore not used. This seems significant, since such grids are to some degree representative of conventional sidewall registers. The possibility exists that the flow from all common types of registers has about the same intensity of turbulence and also that it is of relatively small magnitude. An opinion from the authors on this subject would be appreciated.

The statement that, all other things being equal, an increase in turbulence intensity will decrease the throw of a jet is in agreement with what would be expected. However, the spacing between the three curves of Fig. 4 is different from what I would expect with turbulence intensity as the only variable. Referring to Fig. 3 at 2500 fpm outlet velocity, the nozzle and the screen have about the same intensity and the promoter about twice as much. In Fig. 4, the nozzle and screen yield almost identical curves and the promoter curve is displaced to the left by about 25 percent. The general spacing of the Fig. 4 curves is what would be expected at 2500 fpm outlet velocity; however, Fig. 4 is actually based on a 350 fpm outlet velocity.

Looking again at Fig. 3, at an outlet velocity of 350 fpm, the intensity is about 4.3 percent with the screen, 7.6 percent with the nozzle, and 9.2 percent with the promoter. I would therefore expect that, in Fig. 4, the screen curve would be displaced to the right of the nozzle curve by much more than it is. Fig. 4 indicates that a change in turbulence intensity from 4.3 to 7.6 percent has negligible effect on the jet axial velocity; whereas a change from 7.6 to 9.2 percent has a great effect.

In this connection, I offer the following comments for the consideration of the authors: In our air distribution work at the University of Illinois, we have been using a heated thermocouple anemometer of about the same size as that developed recently by Dr. Nottage at the ASHVE Research Laboratory. This instrument was developed by A. E. Hershey and R. B. Engdahl some 10 years ago, but the details have not been published. In 1950, we recalibrated these anemometers under what we considered were conditions of very low turbulence intensity. The question then arose as to whether the calibration would hold at higher intensities. It was reasoned that the greater fluctuation velocities of higher intensity turbulence would increase the convective heat transfer; consequently, at the same time-mean velocity, the emf generation with high turbulence intensity would be less than that with low turbulence intensity. Therefore, if the intensity were higher than that during calibration, our emf readings would give apparent velocities higher than the actual velocities. Conversely, lower than calibration intensities would give apparent velocities lower than the actual time-mean velocities. In order to investigate this effect, quarter-inch wire mesh, together with three layers of cloth, were placed over the entrance of the draw-through tunnel to increase the turbulence intensity. It should be clearly understood that we had no device with which to measure the actual turbulence intensity; we merely thought that the screen and cloth would increase it. The anemometer was located about 2 ft downstream of the wire and cloth combination. The test results showed that, on a log-log plot with velocity as abscissa and emf as ordinate, a new calibration curve was established below the original curve, which was the expected result based on the reasoning stated. The two curves were sufficiently far apart that, for the same emf reading, the velocities differed by about 25 percent. I feel our experimentation showed the probability, at least, of heated thermocouple anemometers being affected by variation in turbulence intensity.

If we apply this hypothesis; namely, that a heated thermocouple anemometer reads low at lower than calibration turbulence intensities and reads high at higher than calibration intensities, to the test results

presented in the paper, the screen curve in Fig. 4, after corrections, is displaced much more to the right; also, the promoter curve is displaced slightly more to the left. The curves would then be in much better agreement with what I would expect on the basis of Fig. 3. Outlet turbulence intensity would then be even more of a significant factor than indicated by the data in the paper.

This paper is a significant first step in an unexplored field of research in the range of velocities used by air conditioning engineers. I hope this program can be continued. On a practical basis, we need information on the outlet turbulence intensities of all types of supply outlets. Moreover, we should investigate and develop practical field devices to increase the intensity with minimum increase in noise level. In residential air conditioning particularly, the big problem is to get the supply air thoroughly mixed with room air in the small space above the zone of occupancy, and it can be expected that higher turbulence intensities will make this problem easier to solve.

G. L. TUVE, Cleveland (WRITTEN): Turbulence certainly has important effects on air flow and heat transfer, as indicated by Dr. Nottage and his associates. But turbulence is hard to describe accurately, and still harder to measure. If you will look carefully at Dr. Nottage's *turbulence promoter*, Fig. 2, you will see that it is something else too. You might say that the comparison of Fig. 4 is between the stream from a free-open outlet and that from a recessed grille.

This comparison mixes three conflicting effects: (1) the turbulence, as measured by the Schubauer *heated wake* instrument; (2) the higher initial kinetic energy imparted to the same quantity of air in forcing it through a grille of only 44 percent free area; and (3) the suppression of the stream divergence and mixing by recessing the grille three inches behind the wall face.

What the authors have shown is that these effects cancel each other when the average wall-face velocity is 2500 fpm, but that the turbulence effect apparently predominates when the face velocity is very low, such as 350 fpm.

In the 1934 ASHVE TRANSACTIONS (p. 427), C. A. McKeeman and G. L. Tuve presented some results showing that turbulence grids may increase heat transfer as much as 40 percent. The 1944 ASHVE TRANSACTIONS (p. 153) paper by G. B. Priester and G. L. Tuve showed that kinetic energy losses in low velocity jets may decrease the throw considerably below that to be expected from tests at higher velocities. In the 1949 and 1950 ASHVE papers of Alfred Koestel and G. L. Tuve, the corresponding losses and reduced throw of the jet due to grilles, grids or perforated plates were shown.

While Dr. Nottage and his associates confirm these earlier reports, their quantitative data should be used with extreme caution. From their Fig. 3 one must conclude that below 800 fpm their turbulence indicator fails to show a marked difference between the free-open nozzle and the nozzle with grid. Since the higher velocity through the grid more than doubles the initial kinetic energy this result is questionable.

I must agree heartily with the authors' conclusion that we need more research on the quantitative role of turbulence, and I would add that we need more accurate means for describing and measuring the initial characteristics of a ventilating jet.

LINN HELANDER, Manhattan, Kans., remarked that the type of research reported in the paper was helpful to the research project on downward projection of low velocity heated air now in progress at Kansas State College.

L. S. PHILLIPS, Hartford, Conn., referred to his experience in measuring turbulent and laminar air flow. He stated that an instrument operating on the principle of the Schubauer instrument and calibrated in a non-turbulent air stream would give a quantitative measure of turbulence by the change in reading due to cooling effect of the turbulent air.

The authors' closure will be published with the paper in the ASHVE TRANSACTIONS 1952.

The second technical paper, Exploration of a Chilled Jet, by H. B. Nottage, J. G. Slaby, and W. P. Gojsza, Cleveland (see p. 122) was presented in abstract by Dr. Nottage.

C. S. LEOPOLD remarked that in practice the difficulties encountered with falling air streams were not so bad as might be anticipated from the paper. Quantitative information is needed on the effect of ceiling beams upon the air stream and therefore it is desirable that tests to determine such effects be conducted.

CYRIL TASKER, Cleveland, referred to the need for translating the results of air distribution research into practical working information. He stated that a subcommittee under W. A. Grant, Syracuse, N. Y., as chairman, had started to evaluate the results of air distribution research conducted under the program established by the TAC on Air Distribution. The report of the sub-committee will be used as a guide in planning future air distribution research.

In the authors' closure, Dr. Nottage stated that a study of the effect of ceilings was on the research program. The project should be carried on to obtain the needed information.

G. V. Parmelee, Cleveland, presented an abstract of the paper, The Shading of Sunlit Glass — An Analysis of the Effect of Uniformly Spaced Flat Opaque Slats, by G. V. Parmelee and W. W. Aubele (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, June 1952).

E. W. CONOVER, Detroit (WRITTEN): This paper represents a tremendous amount of labor and thought in evolving the mathematical approach to the problem at hand. The authors should be commended for their work.

My comments will take the form of a few questions that are occasioned by some confusion in my own mind. The problem deals with solar radiation from the standpoint of heat gain through sunlit glazed openings. It is stated that Figs. 5 to 10 are strictly applicable only to monochromatic radiation. We would like to ask what the percentage of error might be for sunlight.

Fig. 4 shows a wide variation in absorptance with wave length and slat material. Is the absorptance in the calculations an average for the particular material over the range of the solar spectrum?

I am impressed with the similarity between this problem of heat control and that of light control with flat opaque slats. Do you believe that these same equations and curves could be used for determining light transmission by using the slat absorptance for the visual portion of the solar spectrum?

It will be interesting to see how closely the test data to be reported later will check with this mathematical theory. I hope that the checks will be close. It is quite likely that the tests will follow the trend indicated by the curves but experience teaches us that the values may be quite different due to some items having a greater effect than anticipated. We wish the authors luck in their future investigation.

A. B. CLYMER, Toledo (WRITTEN): The TAC on Heat Flow Through Glass and the authors are to be commended for having conceived and undertaken a research program which will yield accurate results in a useful form with a minimum of effort. This well-integrated program employs a nice balance between theoretical and experimental methods of attack.

Many of the theoretical results reported in this paper have been spot-checked by independent calculations; all items checked have been found to be correct. Hence this paper would seem to enhance the reputation for reliable work which the authors enjoy as a consequence of their previous papers on heat flow through fenestrations.

The authors perhaps understate the immediate value of their results. Although it is true that few non-engineers will even now be able to make practical calculations on the basis of this paper alone, it is now possible for the first time for a number of members and other engineers with allied interests to arrive easily at fairly good estimates of instantaneous heat gain through shaded glass.

It would be of interest, even though probably not of great importance, to know how to take account of variation of slat surface absorptance with the angle of incidence of the radiation upon the slat surface. Suggestions by the authors on this point would be appreciated.

J. P. STEWART, Syracuse, N. Y. (WRITTEN): This is a valuable contribution to our knowledge of solar heat transmission through glass. I look forward with great interest to the experimental work which is to follow. Judging from the authors' conclusions, I gather that diffuse reflecting slats would generally be more effective in reducing the room cooling load than specular reflecting slat surfaces. The usual setting of the angle of the slats seems to be about 45 deg.

R. W. MCKINLEY, Pittsburgh, inquired whether any one angle setting had been found preferable, particularly if the setting were to remain unchanged from day to day.

Another question referred to the possibility of adopting a fixed combination of slat spacing and setting at some location and elevation in a building.

Mr. McKinley also asked whether the results in the paper would also apply to the visible portion of the spectrum.

R. A. MILLER, Pittsburgh, pointed out that the sequence of papers presented on heat transfer through glass was established by the TAC on Heat Flow through Glass, which gave complete cooperation to Mr. Parmelee in the development and carrying out of the program.

CYRIL TASKER stated that a small subcommittee of the TAC on Glass had been invited to re-write the paper in a form which would make the information of immediate practical use. The effect of this experiment might be to improve the presentation of the results of research.

In the authors' closure, Mr. Parmelee, with reference to use of data for sunlight, felt that an average value of absorptance could be used for most cases with ordinary glass. For heat absorbing glass with a particular form of sunshade, it would be necessary to make calculations of heat gain for various wave lengths.

It was also thought probable that the data were applicable to light control as well as heat control problems. Account should be taken, however, of the difference in absorptance and reflectance for the visible portion of the spectrum as compared with the color spectrum.

Mr. Parmelee stated that the information in the paper did not include the effect of dissipation of heat by convection and radiation from the slats and glass.

Referring to Mr. Stewart's comment on a slat angle setting of 45 deg, Mr. Parmelee stated that light control needed to be considered together with the heat control.

In replying to Mr. McKinley's question on preferred angle setting, Mr. Parmelee pointed out that the effect of setting on light admitted needed to be considered in order to satisfy the occupants of the room.

In conclusion, Mr. Parmelee commended the TAC on Heat Flow Through Glass for its valuable technical assistance and its continual interest in the research on glass.

Second Vice President Hunter announced that the last technical paper, A Smoke-Filament Technique for Experimental Research in Room Air Distribution by H. B. Nottage, J. G. Slaby, and W. P. Gojsza (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, July 1952) would be presented by title.

A discussion by S. F. Gilman, Urbana, Ill., was received and will be published later in TRANSACTIONS together with other discussions which may be received.

At the conclusion of the technical session, President Szekely took the chair and called on G. W. F. Myers, St. Louis, to present the report of the Committee on Resolutions.

Chicago — The City For ASHVE In '53

Chicago, the Conrad Hilton Hotel, and the International Amphitheatre, all scenes of recent and memorable political activities, will be hosts to the 59th Annual Meeting of the Society, January 26-30, 1953. Simultaneously with the meeting, the 11th International Heating, Ventilating and Air Conditioning Exposition will be taking place.

From both M. W. Bishop, president of the Illinois Chapter, and W. A. Kuechenberg, general chairman of the Committee on Arrangements, come a cordial invitation to be in Chicago in January. Hotel reservation forms have gone out to all members and early reservations are advised. The Committee and entire Illinois Chapter hope to see you in the Windy City for the 59th Annual Meeting.

Further information about Chicago, the meeting sessions and events, and the Exposition will appear in coming issues of the JOURNAL.

RESOLUTIONS

WHEREAS, the ASHVE Semi-Annual Meeting, 1952 at Spring Lake, New Jersey, is coming to a conclusion; and

WHEREAS, The New York Chapter, through its excellent Committee on Arrangements, has made this an outstanding event; and

WHEREAS, The ladies of the Chapter hosts have so graciously given of their time and efforts to please their fellow members, wives and daughters; and

WHEREAS, the technical portion of the program has given additional enlightenment to our profession; and

WHEREAS, Pres. Ernest Szekely and his Officers have conducted all meetings in an exemplary manner so that time was given for social enjoyment and renewal of friendships; and

WHEREAS, The officers and staff of our headquarters hotel, The Essex and Sussex, have been so thoughtful of our every need and comfort, therefore, be it

RESOLVED, That We, the Members of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS here assembled give due recognition to these men and women of the New York Chapter, to the various Committee Members and to Chairman Frank Faust and Vice Chairman H. P. Morehouse, and we extend to them our heartfelt thanks for a wonderful and varied program of events purposely planned for our pleasure, and further, we express our appreciation to those contributing papers and discussions at our technical sessions, to the Hotel Essex and Sussex, and to President Szekely, his Officers and committees for another successful meeting.

Respectfully submitted,
G. W. Bornquist
D. M. Mills
G. W. F. Myers, *Chairman*

On motion by Mr. Myers, seconded by Mr. Cotton, the resolutions were adopted unanimously.

As there was no further business, the Semi-Annual Meeting of 1952 was adjourned at 12:15 p.m.

ASHVE members and guests enjoy sunny afternoon on Essex & Sussex Beach

Entertainment Highlights in Spring Lake

The entertainment features of the program got underway Sunday afternoon with a get-together tea in the Lounge of The Essex and Sussex, with the early arrivals in attendance. Sunday night movies were shown in the ballroom; one portrayed the scenic beauties of Colorado in anticipation of the 1953 Semi-Annual Meeting scheduled in Denver, and the second, *Belles on Their Toes*, recounted the further adventures of the Gilbreth family of Montclair, N. J. Both were most enjoyable and appropriate. Dr. Lillian M. Gilbreth is the well known consulting engineer and president of Gilbreth, Inc., who was portrayed as head of the family in *Cheaper by the Dozen*. The film was shown through the courtesy of A. A. Bearman of Twentieth Century-Fox Film Corp., a member of the New York Chapter.

Monday morning 70 ladies, children and a few husbands went to New York via bus and the Keansburg Ferry, and had a delightful sail through the Lower Harbor, the Narrows and to the Battery. They saw the Statue of Liberty, Fort Hancock, Sandy Hook, lower Manhattan's famous skyline and on the return trip, the S. S. America just arriving from Europe. For those less nautically inclined a Ladies Card Party and entertainment presenting the Romance of the Music Boxes was held Monday afternoon.

Golf Scores

Players	Gross	Handicap	Net
M. F. Blankin	93	20	73
N. D. Skinner	96	20	76
L. W. McCrea	96	17	79
C. F. Dietz	114	35	79
E. H. Munier	114	22	92
A. M. Robertson	113	25	88
E. K. Wagner	94	20	74
F. H. Buzzard	95	18	77
Albert Giannini	111	22	89
H. R. Limbacher	111	25	86
Bernard Leventhal	122	30	92
J. W. May	95	18	77*
H. S. Wheller	117	42	75
J. F. O'Brien	121	30	91
F. J. Swaney	109	26	83
H. S. Wheller, Jr.	95	28	67†
L. L. Hamig	101	28	73
B. L. Evans	94	19	75
G. W. F. Myers	105	25	80
M. G. Kershaw	109	23	86
G. W. Bornquist	110	34	76
J. S. Kearney	108	26	82
N. R. Gay	103	24	79
W. G. Kane	82**	8	74
Walter Heyward	117	30	87
H. J. Blakeley	122	30	92
F. D. Lawrence	113	31	82
F. A. Fideli	128	30	98
H. J. Rose	92	17	75
H. C. Hull	108	25	83
W. K. Gregory	110	25	85
A. F. Hinrichsen	101	25	76
George Wagner	103	35	68
G. C. Norman	92	16	76
J. P. Davis	127	26	101
P. B. Gordon	115	22	93
L. N. Hunter	104	22	82

*Blind Bogey. †Low net. **Low gross.

Welcome Luncheon

At noon on Monday the Welcome Luncheon was held, with about 300 in attendance. After greetings from P. B. Gordon, president of the New York Chapter of the Society, toastmaster R. D. Terhune introduced G. F. Smith, president, Johnson & Johnson, Inc., and vice chairman of the New Jersey Turnpike Authority. He presented an excellent talk on the Turnpike, outlining briefly some of the problems and difficulties that were surmounted in its construction and how it has justified the faith of its most optimistic backers from both a financial and traffic viewpoint.

Golf Tournament

The golf tournament on Monday, played at the Spring Lake Golf and Country Club, went smoothly after a couple of tricky first holes, with honors going to H. S. Wheller, Jr., of Orange, N. J., winner of the Research Cup, for low net score; and to the Philadelphia Chapter represented by M. F. Blankin, E. K. Wagner, and F. H. Buzzard, for the low net three-man combined score

(Left) The chef and assistants serving the salmon preparatory to the main attraction at the Clambake — the lobster

from one chapter, which brought them the Eichberg Memorial Trophy. The Paul Bunyan Cup went to F. A. Fideli of Carle Place, L. I., N. Y., for high gross. The cups and awards were presented at the Banquet on Wednesday.

In addition to the cups other awards were: Low gross score, an engraved silver bowl to W. G. Kane of Port Washington, L. I., N. Y., who also won three golf balls for longest first hole drive, over 280 yards; blind bogey, an electric clock to J. W. May of Louisville, Ky.; low net, a cocktail set to H. S. Wheller, Jr., of Orange, N. J., who also won three golf balls for lowest number of putts on 18 holes; nearest to pin on eighth hole, J. F. O'Brien of Springfield, N. J.; nearest to pin on tenth hole, N. D. Skinner of Indianapolis; and lowest total on the par 3 holes won by L. W. McCrea of Baltimore; each of the latter winning three golf balls.

Monday night saw the arrival of the beachcombers in The Essex and Sussex ballroom, at the Beachcomber's Party. Following an enthusiastically received entertainment program of talented youngsters from New Jersey, awards were distributed for the funniest and most original costumes.

The judges, Mrs. Ernest Szekely, Milwaukee, M. C. Beman, Buffalo,

The Beachcombers

The Fishermen

(Right) The Clambake attracted capacity crowd to the Essex & Sussex Beach

Semi-Annual Banquet features address by outstanding engineer and presentation of golf awards

and R. H. Carpenter, New York, presented souvenirs to Mrs. J. S. Locke, Minneapolis, Mrs. T. H. Urdahl, Washington, D. C., G. Lorne Wiggs, Montreal, A. J. Hess, Los Angeles, and Miss Barbara Seeley, Durham, N. H. Children's favors went to Diane Beavers, Toronto, Betty Evans, St. Louis, and Patricia Hunter, Johnstown, Pa.

The Clambake

Tuesday morning an overflow crowd of ladies and children were entertained with an excellent magic show presented by the Battons of Fort Monmouth.

On Tuesday afternoon the entertainment highlight of the meeting, the Clambake, was held on the beach of The Essex and Sussex with over 350 members, wives, and guests in attendance. A succulent dinner of clam broth, steamed clams, salmon, baked potatoes, corn on the cob, lobster and watermelon was enjoyed by everyone on the warm breezy beach, with the blue Atlantic serving as an enchanting background.

Wednesday morning was given over to relaxing and swimming by a majority of the ladies while the small group who went sightseeing through Asbury Park, Deal, and Atlantic Highlands were rewarded by seeing some of the country's most fabulous summer homes, plus a beautiful view of New York Harbor, Staten Island and Fort Hancock at the tip of Sandy Hook. On Wednesday afternoon 70 people took the ride to Lakehurst

Pres. & Mrs. Ernest Szekely

Patricia Hunter
Johnstown, Pa.

Betty Evans
St. Louis

D. M. Mills, Houston, M. K. Fahnestock, Urbana, Ill., John James, Chicago

Mr. and Mrs. G. B. Supple, and H. E. Sproull

M. E. Barnard

I. W. Cotton, G. L. Tuve and L. N. Hunter

Naval Air Station and had an interesting tour seeing the Navy's blimps, helicopters and the world's largest dirigible which had arrived from Akron only two days previously.

Banquet

The meeting came to a fitting climax on Wednesday night when 300 members, ladies, and guests attended the Semi-Annual Banquet at which J. C. Fitts, secretary, *Heating, Piping & Air Conditioning Contractors National Association,* was the capable and entertaining toastmaster, and Col. W. G. McKinley, staff engineer for the New York Telephone Co., and a lifelong resident of Jersey City, N. J., brought home to his listeners forcefully and well the importance of taking an active part in their community life in his address, *The Engineer as a Citizen.* Following the Banquet the evening was concluded with dancing in the ballroom.

Meetings

During the course of the meeting, in addition to the regular Council and Committee on Research meetings, numerous other committees met. These included the Nominating Committee, Guide Committee, an informal meeting of the Chapters Conference Committee, and the Technical Advisory Committees on Odors, Sorption, Heating Load, Combustion, Heat Flow Through Glass, Industrial Ventilation and Committee on Revision of Code of Minimum Requirements for Comfort Air Conditioning.

Thanks are due to all the New Jersey members of the New York Chapter's Committee on Arrangements who worked hard to make the meeting a success and to the management and staff of The Essex and Sussex for their cooperation and conscientious efforts that contributed so much to making the stay of the members, their families and guests at the Meeting-by-the-Sea so memorable and enjoyable.

(The pictures taken during the Semi-Annual Meeting, and shown on these pages, are published through the courtesy of William Wallace, II, Durham, N.C.)

*Summary of Chapter Meetings**

• *ARKANSAS:* Bruce Manees, Arkansas Power and Light Co., was the guest speaker at the Chapter's June meeting. Mr. Manees spoke on the *Operating System of Power Generation and Transmission for Arkansas and the Surrounding Area.* In his address, he made special mention of the fact that the power company should be informed of any special electrical problems arising in industry in order that it may cooperate with industry in solving the problems. He also stated that steam generation plants supply the bulk of the energy for this area.

A letter of congratulations to the new Chapter from J. Donald Kroeker, treasurer of the Society and a member of the Oregon Chapter, was then read. It was also announced that Mr. Kroeker had presented the Chapter with a myrtle wood gavel with which to conduct future meetings. Attendance 26. Attendance ratio 0.40.

• *ARKANSAS:* H. Cumnock introduced H. N. Stall, sales engineer, Southern Heater Co., New Orleans, La. Mr. Stall, who is a graduate mechanical engineer from Tulane University, spoke on *Packaged Chilled Water Units and Air Conditioning Systems* ranging from 2 tons up to 20 tons. A question and answer period followed the talk.

R. E. Blaylock made a motion, which was seconded by E. C. Marcum, that Pres. E. N. Pettit appoint a committee to study and recommend a heating and ventilating code to state school authorities for the Arkansas School System. The meeting was held in the Albert Pike Hotel on May 20. Attendance 37. Attendance ratio 0.60.

• *BRITISH COLUMBIA:* The feature of the May meeting, held at the Quadra Club, was the showing of the film, *Oil Line Construction Through*

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

Texas. The film, shown through the courtesy of the Shell Oil Co., was described briefly preceding the showing by Jack Edmondson of Shell Oil Co.

R. B. McDonnell, chairman of the by-laws committee, read the proposed by-laws of the Chapter paragraph by paragraph. Following a detailed discussion it was moved that the by-laws be accepted as amended. Attendance 38.

• *CENTRAL OHIO*: Following dinner, the May meeting came to order at 8:00 p.m. and J. R. Garvey, of the *Bituminous Coal Research Association*, was introduced as the guest speaker. Mr. Garvey spoke on *The Fight for a Free World* in which he emphasized the importance coal is playing in this struggle. He also related that the country's coal output totals some 500 million tons per year and that although our coal miners now dig 7 tons per man a day it is expected that new machinery will eventually bring this figure up to 100 tons per man daily.

The meeting, which was held in the Grandview Inn, was adjourned at 9:30 p.m. Attendance 34.

• *DELTA*: The election of new officers was conducted at the Chapter's May meeting with the following results: *President* — Walter Cooke; *Vice President* — H. L. Salaun; *Secretary* — T. J. Jenny; *Treasurer* — C. V. Bankston; *Board of Governors* — J. J. Friedler, Jr. and E. O. Thoman. This was followed by the presentation of the various annual reports by the officers and committee chairmen. President Cooke was presented with the gavel and the Chapter's charter, which he acknowledged with a few brief remarks.

B. H. White was introduced by Mr. Bankston and he spoke on *Breeze Conditioning for Profit.* A question and answer period followed the talk. Attendance 25.

• *EMPIRE STATE CAPITAL*: The program scheduled for the evening was a panel discussion on the various phases of air conditioning. Each speaker was limited to 10 minutes for his presentation; and Harry Horowitz acted as moderator. Speakers and their subjects were as follows: G. G. Davis — *air filtration;* N. W. Burrill — *refrigeration;* E. J. Mahoney — *electric temperature controls;* Loran Appleby — *pneumatic temperature controls;* R. B. Taylor — *fans and blowers;* F. A. Weinbender — *sheet metal works;* F. R. Foote — *diffusers and grilles.* Following the discussion, the meeting was turned into a question and answer period.

Previous to the panel discussion, Mr. Foote reported on the nominating committee's recommendations for officers for 1952-53. The meeting, held at the Crossroads Restaurant on May 21, was called to order by Pres. D. A. Carofano and followed the dinner which was attended by 34 people.

• *INLAND EMPIRE*: The main order of business at the Chapter's May meeting was the election of new officers for 1952-53. The results of the election of officers are as follows: *President* — T. P. Nau; *Vice President* — G. M. Dieter; *Secretary* — H. A. Bickle; *Treasurer* — F. W. Jenkinson; *Board of Governors* — Max Tonn and P. R. Inman. Incoming President Nau, in his acceptance speech, gave a resumé of his plans for the coming season and announced his choice of committee chairmen as follows: *membership* — J. L. Harvey; *attendance* — L. E. Harris; *finance* — Ralph Nelson, Jr.; *publicity* — J. E. Hutsinpiller; and program — G. M. Dieter.

The election of officers was preceded by a few announcements and reports by the various committee chairmen. Attendance 22.

• *MANITOBA*: The May meeting was in the form of the annual golf party, followed by a dinner-dance in the Pine Ridge Golf Club. Awards were made to those with low gross, and although it was apparent that the guests made out better than the membership, Pres. J. F. Bertram kept the honors for the Chapter by attaining the high gross, and Ernest Lambert won the low net on the fourth with a birdie.

The officers for the 1952-53 season were then introduced, and the dancing followed until 11:30 p.m. Attendance 41.

• *MICHIGAN*: A total of 70 members and guests took part in the Chapter's Annual Golf Tournament at the Meadowbrook Country Club on June 3. The golfing was followed by a dinner in the Club, which was enjoyed by a total of 110 members and guests.

After dinner, Pres. G. W. Akers called the meeting to order and expressed his appreciation for the cooperation of the officers, members of the board of governors, and committee chairmen during his term of office. He also announced that detailed committee reports would be included in the final president's letter which would be mailed to the membership.

The election of the following officers for 1952-53 was then announced: *President*—C. A. Strand; *Vice President*—R. H. Oberschulte; *Secretary*—D. S. Falk; *Treasurer*—E. F. Glanz; *Board of Governors*—G. L. Davis, Jr., D. L. McConachie, J. N. Livermore.

• *NEBRASKA*: The June meeting was given over to Ladies Night, and upon arrival at the Omaha Country Club, each lady was presented with a corsage, compliments of the Chapter. Following the social hour, during which suitable music was supplied by an instrumental trio, 32 couples enjoyed a buffet dinner.

At the conclusion of the dinner, Pres. K. E. Martin called the meeting to order and G. W. Colburn announced the results of the election of officers for 1952-53 as follows: *President*—S. W. Black; *Vice President*—O. J. Smith; *Secretary*—H. H. Ulrich; and *Treasurer*—C. A. Goth.

Retiring President Martin presented the gavel to incoming President Black, who made a few appropriate remarks. Past President

Colburn then presented the past president's pin for 1951-52 to Mr. Martin.

The rest of the evening was devoted to various forms of entertainment. Attendance 64.

• *NORTHEASTERN OKLAHOMA*: The feature of the evening was an address on *Newer Concepts of Warm Air Heating*, by C. W. Nessell, account executive, Minneapolis-Honeywell Regulator Co., Chicago, Ill. Mr. Nessell, who is chairman of the Field Investigation Committee of the *National Warm Air Heating and Air Conditioning Association*, based his talk on actual data collected by the Committee. Mr. Nessell, whose work with the association provides him with an intimate knowledge of the latest developments and trends in warm air heating, gave much valuable information on the application of warm air perimeter heating systems.

Three new Chapter members, L. A. Ives, O. D. Shaddox, Jr., and R. L. Sigler, were introduced at the meeting, which was held at the University of Tulsa Student Activities Building on June 10. Attendance 41. Attendance ratio 0.52.

• *NORTHEASTERN OKLAHOMA*: J. W. May, technical director, Air Filter Division, American Air Filter Co., Louisville, Ky., spoke on the subject, *Types of Air Filters and Their Specific Applications*. A question and answer period followed the talk.

Pres. C. H. Dollmeyer called the May 13 meeting to order, and the minutes of the April meeting and the treasurer's report were read and approved. J. N. Watt, program chairman, announced the program for the June meeting. Attendance 28. Attendance ratio 0.53.

• *OKLAHOMA*: At the Chapter's May meeting, the election of officers took place with the following results: *President*—W. J. Collins, Jr.; *Vice President*—A. R. Morin; *Secretary*—F. X. Loeffler, Jr.; *Treasurer*—G. E. Ervin; *Board of Governors*—G. T. Donceel, H. S. Shafer, and J. H. Carnahan.

After considerable discussion, a motion was made, seconded and passed to the effect that the Oklahoma Chapter participate in the Society's Research Program to the extent of establishing a cooperative arrangement with the University of Oklahoma and that a Chapter research committee be appointed to explore and promote the project. Attendance 47. Attendance ratio 0.45.

• *PHILADELPHIA*: The total attendance was 192 at the Chapter's May Annual Golf Outing, held at the Tavistock Country Club. Awards for the best golfers were presented at the meeting which followed the golfing.

Retiring Pres. E. K. Wagner introduced the new officers elected at the April meeting to the members and guests.

• *SHREVEPORT*: The June meeting, which was a Beachcomber's Party, was held at Irvine's Place on Cross Lake. Members, their wives, and guests enjoyed a social hour followed by a fish-chicken dinner. The rest of the evening, quite naturally, was devoted to fun and entertainment, and Mrs. M. A. Hudson, wife of the Chapter's secretary, was rewarded for the best costume and Mrs. R. S. Segall also received a gift. Attendance 56. Attendance ratio 0.58.

• *SOUTHERN PIEDMONT*: Robert Fullerton, Carrier Corp., gave an address on *Air Conditioning of a Textile Mill*, which was illustrated by color slides. Pres. R. M. Warren expressed the Chapter's appreciation for the fine presentation made by Mr. Fullerton.

J. G. Hopping, Jr., a new Chapter member and originally a member of the Southwest Texas Chapter, brought greetings from his fellow Texan, Reg F. Taylor, first vice president of the Society.

President Warren called the June meeting to order, following a social hour and dinner at the Cardinal Restaurant. Attendance 40.

• *UTAH*: The guest speaker of the May meeting was A. J. Hess, president, Hess-Greiner & Polland, Los Angeles, Calif. Mr. Hess, who is a member of the Society's Committee on Research and the Chapter Relations Committee, gave a comprehensive talk on the ASHVE Laboratory in Cleveland. In his talk, Mr. Hess told of the work that is being done at the Laboratory and how the various projects are financed. He also explained the cooperative research program which the Society maintains with various governmental agencies, colleges and universities. In closing, Mr. Hess extended an invitation to anyone who might be traveling through Cleveland to visit the Society's Research Laboratory.

The officers elected at the April meeting, *President*—D. R. Wilde, *Vice President*—M. L. Gollaher, and *Secretary-Treasurer*—Alfred Richeda, were installed. Retiring Pres. A. R. Curtis asked for the floor and expressed his appreciation for the cooperation he had received during the year from the officers and committees. Attendance 21.

• *WESTERN MICHIGAN*: Bad weather prevented most of the members from playing golf; and although 14 members braved the rainy weather, the rest of the group played indoor games, such as horseshoes, darts, cards, etc. Following a steak dinner, awards were given for the various games played.

The election of officers was held and the following were elected for 1952-53: *President* — H. R. Limbacher; *Vice President*—R. W. Mangrum; *Secretary*—F. K. Platt; *Treasurer*—L. A. Tilford; *Board of Governors*—W. C. DeRoo, R. J. Waalkes, and P. D. Winchester. Incoming President Limbacher presented the past president's plaque to Retiring Pres. W. C. DeRoo, who in turn presented the Chapter Charter to President Limbacher. Attendance 54. Attendance ratio 0.44.

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month there have been 46 applications for membership, including 2 reinstatements; in addition 6 advancements have been received. The names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by August 29, 1952, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

Note: †Reinstatement. △Advancement. *Non-member.

California

BECK, F. J., Specialist, Military Sea Transportation Service, San Francisco. REFERENCES: A. L. Buonaccorsi, E. F. Dill, J. E. Murray, Clyde Wilson-Reid.

BUTLER, S. O., Htg. & Vent. Foreman, Los Angeles City Board of Education, Los Angeles. REFERENCES: J. S. Earhart, E. C. Evans, M. C. Greiner, S. W. Norton*.

DENTON, J. E., Mech. Engr., Van Dyke & Barnes, Archts. & Engrs, Los Angeles. REFERENCES: B. M. Lemos, C. S. Singman*, J. P. Stratford*, E. B. Wolford*.

△LEAS, N. N., Mgr., Conditioned Air & Refrigeration Co., Fresno. REFERENCES: F. W. Jordan, R. D. Knowles, H. A. McCandless, G. W. Turner*.

OLIPHANT, H. B., Pres., Oliphant Commercial Corp., Oakland. REFERENCES: A. N. Brewer*, J. M. Hagler*, J. E. Hedquist, A. N. Walton*.

Colorado

EGAN, W. R., Dist. Mgr., Surface Combustion Corp., Denver. REFERENCES: F. L. Adams, Fred Janssen, D. M. Mills, William Van Genderen.

Connecticut

DEMINO, J. J., Sr. Dept. Head, State Dept. of Education, New Britain. REFERENCES: F. L. Hausser, Dr. H. Welte*, H. H. Wilber*, Archie Wilson*.

District of Columbia

BERBETT, S. N., Engr., Glenn D. Culbert Co., Washington. REFERENCES: R. R. Cover, L. D. Toolan, G. R. Walz, D. W. Whittington.

Florida

†KOONS, J. C., Mgr., Modern Air Conditioning, Tallahassee. REFERENCES: J. S. Beazley*, Prentiss Huddleston*, H. S. Satterfield*, Charles Saunders*.

Illinois

△FREYDER, G. G., Engr., Commonwealth Edison Co., Chicago. REFERENCES: C. M. Burnam, Jr., W. A. Kuechenberg, P. J. Marschall, G. V. Zintel.

△MAY, A. O., Vice Pres., Stannard Power Equipment Co., Chicago. REFERENCES: J. J. Aeberly, C. M. Burnam, Jr., J. J. Hayes, E. P. Heckel.

Indiana

HENKE, P. E., Engr., The National Engineering Co., Indianapolis. REFERENCES: J. B. Brill*, I. W. Cotton, E. P. Nelson*, Harvey Rockwell*.

Kansas

BURGESS, W. E., Bldg. Engr., Southwestern Bell Telephone Co., Topeka. REFERENCES: Tom Everly*, L. M. Haley*, Bruce Johnson, Fred Vasey*.

DEWHIRST, L. T., Owner, Lee Dewhirst Co., Wichita. REFERENCES: R. F. Bauer, C. C. Chappell*, H. E. Keener, R. L. Pennington.

Michigan

HILLERY, J. F., JR., Engr., American Blower Corp., Detroit. REFERENCES: C. J. Henstock, D. J. King, H. E. Paetz, J. J. Uicker.

Minnesota

JOHNSON, R. W., Designer, Roberts-Hamilton Co., St. Paul. REFERENCES: A. L. Hum, R. A. Koch, B. P. Mooney, H. P. Roberts.

Nebraska

BELL, W. V., Indus. Engr., Metropolitan Utilities District, Omaha. REFERENCES: S. W. Black, Jerry Coburn*, K. R. Magarrell, M. J. Olson.

New York

APPLEBY, L. V., Engr., Johnson Service Co., Albany. REFERENCES: C. D. Cross, G. G. Davis, Harry Horowitz, R. B. Taylor.

ARTECA, NICHOLAS, Htg. & Vent. Designer, Guy B. Panero, New York. REFERENCES: E. Deaz*, William Hollis*, T. J. Rauh*, S. Simble*.

BOND, H. S., Engr., Horace A. Bond, Cons. Engr., Albany. REFERENCES: C. D. Cross, F. W. Sheldon, R. B. Taylor, R. J. Tougher.

△DEVINE, T. M., Treas., M. J. Devine & Son, Amsterdam. REFERENCES: Ben Kroup*, L. H. Niles*, Maurice Richardson*, J. D. Smeallie*.

DEWINDT, A. K., Mech. Designer, Seelye, Stevenson, Value & Knecht, Cons. Engrs., New York. REFERENCES: W. T. Cleland*, A. W. Knecht*, C. L. Landfried*, E. B. J. Roos*.

DOYLE, E. C., Mgr., Johnson Service Co., Albany. REFERENCES: H. A. Bond, C. D. Cross, M. F. Rather, R. B. Taylor.

O'ROURKE, N. T., Partner, Neal T. O'Rourke & Assocs., Buffalo. REFERENCES: M. C. Beman, M. E. Davis, J. B. Magee*, J. M. Quackenbush.

OTTENHEIMER, J. L., Cons. Engr., Albany. REFERENCES: G. G. Davis, F. R. Foote, Harry Horowitz, R. B. Taylor.

STEWART, ISAAC, Chief Engr., New York Testing Laboratories, Inc., New York. REFERENCES: G. J. Horvitz*, W. C. Kahn, Jr., K. O. Schlentner, H. B. Steggall.

STRICKLAND, E. B., Sales Mgr., John L. Strickland & Son, New Hartford. REFERENCES: I. W. Gilbert, H. K. Ormsby, Jr., P. D. Robson, C. F. Woese.

North Carolina

BIBERSTEIN, H. V., Cons. Engr., Biberstein, Bowles & Meacham, Inc., Charlotte. REFERENCES: C. Z. Adams, Kirkpatrick Cousart, E. S. DeWitt, W. H. Reed III.

COOPER, W. S., Engr., American Blower Corp., Charlotte. REFERENCES: E. S. DeWitt, C. R. Harris, R. O. McGary, F. B. Morse.

FUSSELL, J. W., Appl. Engr., Minneapolis-Honeywell Regulator Co., Charlotte. REFERENCES: R. S. Fullerton, L. F. Lawrence, Jr., R. M. Warren, Jr., W. P. Wells.

GOFORTH, R. W., Constr. Mgr., Carrier Corp., Charlotte. REFERENCES: R. S. Arnold, R. S. Fullerton, R. H. Gray, W. H. Reed III.

HOLLOWAY, R. C., Engr., The American Moistening Co., Charlotte. REFERENCES: L. F. Lawrence, Jr., R. O. McGary, Norman Sharpe, E. D. Streng.

MEACHAM, L. H., Sec'y. & Asst. Treas., Biberstein, Bowles & Meacham, Inc., Charlotte. REFERENCES: Kirkpatrick Cousart, E. G. Embree, W. H. Reed III, W. E. Stowe, Jr.

STEPHENSON, A. M., Mgr., Applied Engineering Co., Charlotte. REFERENCES: E.

G. Embree, C. E. Petty, W. E. Stowe, Jr., W. P. Wells.

Ohio

FARR, R. A., Mgr., Gary G. Schultz & Assocs., Columbus. REFERENCES: W. R. Kinney, F. J. Lilly, J. A. Myers, Julian Speer.

SCHROEDER, G. B., Mgr., Educational Dept., Lennox Furnace Co., Columbus. REFERENCES: C. O. Norland, C. A. Reichelderfer, R. C. Robbins, R. J. Schmitz, Jr.

SMITH, L. D., Appl. Engr., York Corp., Cincinnati. REFERENCES: L. R. Craig, R. W. Geltz*, T. D. Reiley, J. A. Schurman*.

STEFFENS, W. P., Mfrs. Repr., Columbus. REFERENCES: Jack Groeniger, W. W. Lige, R. E. Moore, R. A. Patterson.

Pennsylvania

GRAUL, J. W., Sales Mgr., Domestic Pump & Mfg. Corp., Shippensburg. REFERENCES: W. W. Dillon, George Meleney*, W. C. Reamy, Jr., A. O. Roche, Jr.

McMANUS, J. L., Owner, McManus Heating Co., Pittsburgh. REFERENCES: Leo Gierl*, R. H. Porter*, Orrin Shamblin*, O. L. Williams.

†MINKLER, W. A., Assistant to Mgr. of Engrg., Westinghouse Electric Corp., Atomic Power Div., Pittsburgh. REFERENCES: E. C. Hach, L. G. Huggins, J. C. Reynolds, J. N. Riley.

Washington

SPIESE, FRANKLYN, Mech. Engr., John Graham & Co., Seattle. REFERENCES: L. F. Christofferson, Arthur Herzog, R. R. Kirkwood, J. B. Notkin.

STIEFF, F. S., Mech. Engr., John Graham & Co., Seattle. REFERENCES: N. J. Handman, Arthur Herzog, R. R. Kirkwood, J. B. Notkin.

Wisconsin

STEVENSON, W. A., Pres., Air Control Inc., Stevenson Div., La Crosse. REFERENCES: H. R. Frankle, M. S. Frankle, W. T. Swingle, P. W. Wintroub.

YATES, J. L., Mgr. of Mfg., Inland Steel Products Co., Milwaukee. REFERENCES: M. W. Crew, M. M. Herrick, R. L. McIlvaine, J. R. Vernon.

Canada

BULLIS, S. J., Htg. Engr., Beach Foundry Ltd., Ottawa. REFERENCES: H. F. Randolph, W. J. Robinson, R. H. Soderlind, Jr., Clifford Strock.

EVANS, S. B., Chief Engr., The T. Eaton Co., B.C., Ltd., Vancouver. REFERENCES: S. C. Gale, R. D. Hale, M. E. Minaker, D. W. Thomson.

MUSSUN, H. R., Htg., Vent. & Air Cond. Engr., Margison, Babcock & Assoc. Ltd., Cons. Engrs., Toronto. REFERENCES: G. R. Beavers, A. M. Clark, W. J. Hiscock, A. D. Margison*.

Sweden

WENNBERG, K. G., Engr., Elis Runefelt Ingeniorsbyra, A. B., Stockholm. REFERENCES: Nicolai Alfsen, Gunnar Frenger, A. F. Rosell, John Rydberg.

OBITUARIES

JOHN C. REED
Louisville, Ky.

John C. Reed, vice president of research, American Radiator and Standard Sanitary Corp., a member of the Society since 1946, died in Louisville, Ky., on June 14, 1952. Born

J. C. Reed

in Glenfield, Pa., on May 20, 1902, Mr. Reed was graduated from Pennsylvania State College with a degree in mining engineering. Upon graduation he joined Vesta Coal Co. as a mining engineer and in 1929 he joined American Radiator as a metallurgist in the Research Department and later became a production engineer in the firm's general manufacturing department.

In 1946 he became manager of the Research Department and subsequently vice president in 1951. During this time the heating laboratory was moved from Yonkers, N. Y., to Louisville. He was a member of the *American Chemical Society*, the *American Institute of Mining and Metallurgical Engineers*, the *American Society of Mechanical Engineers*, *and the American Society of Sanitary Engineers*.

The Officers and Council of the Society extend their sincere sympathy to Mr. Reed's widow, Mrs. Elizabeth M. Reed, and to his sisters, Mrs. R. Laird Auchmuty and Mrs. William C. Lepper.

VIC SANDERS
Pittsburgh, Pa.

Vic Sanders, manager, Industrial Insulation Department of the Pittsburgh Corning Corp., Pittsburgh, passed away on June 20, 1952. He became an associate member of the Society in 1945 and in 1950 was elevated to member grade.

He was born at Pikeville, Ky., on May 4, 1902 and graduated from Tulane University. He later attended the University of Cincinnati. He was formerly with Cincinnati Gas and Electric Co., and was later associated with the Autogas Corp., Division of Republic Flow Meters Co., and Fairbanks Morse. Prior to joining Pittsburgh Corning in 1944 he served as chief engineer of the Insulation Division of Eagle Picher Sales Co. from 1940-44.

He was formerly a member of the TAC on Glass, and at the time of his death a member of both the TAC on Heat Flow Through Glass and the TAC on Insulation.

The Officers and Council extend their deepest sympathy to his widow.

EDWIN B. MILLER
Birmingham, Ala.

Edwin B. Miller, sales engineer, C. A. Dunham Co. and prominent consulting engineer in Birmingham, Ala., died in Birmingham on June 24, 1952. A member of the Society since 1946, Mr. Miller was born in Sparrows Point, Md., September 14, 1895, and was graduated from Pennsylvania State Forestry Academy in 1917, and served two years in the Army during World War I. Following seven years with the Pennsylvania Department of Forests and Waters, he became manager of the Cambria Plumbing and Heating Co., Johnstown, Pa., in 1927. In 1940 he joined Westinghouse Construction Department and subsequently worked for the Austin Co., Cleveland. He joined the C. A. Dunham Co. in 1946.

The Officers and Council extend their profound sympathy to his son, Edwin B. Miller, Jr., and to the other members of Mr. Miller's family.

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● **ATLANTA:** 1937. Hdqrs., Atlanta, Ga. Meets, Second Monday. PRESIDENT, F. A. Player, 2110 Peachtree Rd., N. W. SECRETARY, J. M. Lazenby, 2641 Merry Lane, N. E., (6).

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● **CENTRAL NEW YORK:** 1944. Hdqrs., Syracuse, N. Y. Meets, Fourth Wednesday. PRESIDENT, J. H. Carpenter, 3515 Midland Ave. SECRETARY, H. K. Ormsby, 205 S. Townsend St. (2).

● **CENTRAL OHIO:** 1944. Hdqrs., Columbus, Ohio. Meets, Third Monday. PRESIDENT, A. D. Bogen, 330-34 E. Livingston Ave. (15). SECRETARY, J. A. Guy, 219 King Ave. (1).

● **CINCINNATI:** 1932. Hdqrs., Cincinnati, Ohio. Meets, First Tuesday. PRESIDENT, H. E. Russell, 4th & Main Sts., Box 960. SECRETARY, F. W. Wilson, 222-24 E. 14th St.

● **CONNECTICUT:** 1940. Hdqrs., New Haven, Conn. Meets, Third Thursday. PRESIDENT, T. L. Arnold, 26 Francis Ave., Hartford (6). SECRETARY, C. L. L'Hommedieu, 76 Blatchley Ave.

● **DELTA:** 1939. Hdqrs., New Orleans, La. Meets, Third Tuesday. PRESIDENT, Walter Cooke, 816 Howard Ave. (13). SECRETARY, T. J. Jenny, 1000 S. Peters St. (9).

● **EMPIRE STATE CAPITAL:** 1951. Hdqrs., Albany, N. Y. PRESIDENT, Harry Horowitz, 889 Warren St. (3). SECRETARY, R. J. Tougher, Menands Rd., Loudonville, N. Y.

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● **INDIANA:** 1943. Hdqrs., Indianapolis, Ind. Meets, Fourth Tuesday. PRESIDENT, J. T. Hardin, 720 Noble St. (2). SECRETARY, P. O. Patterson, 6300 N. Oakland Ave. (18).

● **INLAND EMPIRE:** 1950. Hdqrs., Spokane, Wash. Meets, First Friday after First Tuesday. PRESIDENT, L. E. Marque, 3803 N. Atlantic. SECRETARY, R. J. Harris, 116 N. Division St., (8).

● **IOWA:** 1940. Hdqrs., Des Moines, Ia. Meets, Second Tuesday. PRESIDENT, R. H. Schnell, 1617 33rd St. (11). SECRETARY, Bowen Campbell, 1433 Casady Dr. (5).

● **KANSAS:** 1951. Hdqrs., Wichita, Kan. PRESIDENT, O. P. Bullock, 254 Laura (7). SECRETARY, H. D. Speyer, 120 Ida.

● **KANSAS CITY:** 1917. Hdqrs., Kansas City, Mo. Meets, First Monday. PRESIDENT, W. A. Reichow, 1621 E. 31st St. (3). SECRETARY, J. G. Barnes, Jr., 1924 Oak St.

● **MANITOBA:** 1935. Hdqrs., Winnipeg, Man., Canada. Meets, Third Thursday. PRESIDENT, W. J. Atkinson, 812 Boyd Bldg. SECRETARY, Ernest Lambert, 93 Lombard St.

● **MASSACHUSETTS:** 1912. Hdqrs., Boston, Mass. Meets, Third Tuesday. PRESIDENT, G. B. Torrens, 15 Alden Lane, Shrewsbury. SECRETARY, G. D. Fife, 79 Milk St. (9).

● **MEMPHIS:** 1944. Hdqrs., Memphis, Tenn. Meets, Third Monday. PRESIDENT, W. L. Drake, 15 N. Reese. SECRETARY, A. T. Bevil, 212 Robinson Bldg., 160 Union (3).

● **MIAMI VALLEY:** 1950. Hdqrs., Dayton, Ohio. Meets, First Wednesday. PRESIDENT, D. L. Bergman, Box 95, Riverdale Sta. (3). SECRETARY, D. E. Tullis, 1720 Park Pl. (6).

● **MICHIGAN:** 1916. Hdqrs., Detroit, Mich. Meets, First Monday after 10th of month. PRESIDENT, C. A. Strand, 9117 Hamilton Ave. (2). SECRETARY, D. S. Falk, 4864 Woodward Ave. (1)

● **MINNESOTA:** 1918. Hdqrs., Minneapolis, Minn. Meets, First Monday. PRESIDENT, William Sturm, 2160 Highland Pkwy., St. Paul (5). SECRETARY, J. G. Hamm, 850 Cromwell Ave., St. Paul (4).

● **MONTREAL:** 1936. Hdqrs., Montreal, Que., Canada. Meets, Third Monday. PRESIDENT, W. G. Hole, 140 Prince St. SECRETARY, D. L. Lindsay, 1411 Crescent St. (25).

● **NEBRASKA:** 1940. Hdqrs., Omaha, Neb. Meets, Second Tuesday. PRESIDENT, S. W. Black, 18th & Harney Sts. SECRETARY, H. H. Ulrich, 507 City Hall (2).

● **NEW YORK:** 1911. Hdqrs., New York, N. Y. Meets, Third Monday. PRESIDENT, P. B. Gordon, 222 E. 41st St. (17). SECRETARY, Carl H. Flink, 62 Worth St. (13).

● **NORTH TEXAS:** 1938. Hdqrs., Dallas, Tex. Meets, Third Monday. PRESIDENT, R. E. Allison, 607-11 First Ave. (10). SECRETARY, M. W. Brown, 1213 Texas Bank Bldg. (2).

● **NORTHEASTERN OKLAHOMA:** 1948. Hdqrs., Tulsa, Okla. PRESIDENT, C. H. Dollmeyer, Jr., 1533 N. New Haven Ave. (15). SECRETARY, V. W. Miles, 624 So. Boston Ave., Box 871.

● **NORTHERN OHIO:** 1916. Hdqrs., Cleveland, Ohio. Meets, Second Monday. PRESIDENT, John Richmond, 10210 Woodland Ave. (4). SECRETARY, R. G. Huebscher, 7218 Euclid Ave. (3).

● **NORTHERN PIEDMONT:** 1952. Hdqrs. Greensboro, N.C. PRESIDENT, L. L. Vaughan, P.O. Box 5746, Raleigh. SECRETARY, J. W. Bunn, Jr., 2705 Lochmore Dr., Raleigh.

● **OKLAHOMA:** 1935. Hdqrs., Oklahoma City, Okla. Meets, Second Monday. PRESIDENT, W. J. Collins, Jr., 1708 Westminster Pl. SECRETARY, F. X. Loeffler, Jr., 1604 N. W. Fifth St.

● **ONTARIO:** 1922. Hdqrs., Toronto, Ont., Canada. Meets, First Monday. PRESIDENT, J. H. Ross, 1251 Yonge St. SECRETARY, H. R. Roth, 57 Bloor St., W.

● **OREGON:** 1939. Hdqrs., Portland, Ore. Meets, Thursday after First Tuesday. PRESIDENT, K. E. Hanson, 104 S.E. Seventh (14). SECRETARY, W. R. Norte, P.O. Box 3918.

● **PACIFIC NORTHWEST:** 1928. Hdqrs., Seattle, Wash. Meets, Second Tuesday. PRESIDENT, W. B. Pride, 5111 Dose Ter. (44). SECRETARY, I. L. Winsor, 105 Orcas St. (8).

● **PHILADELPHIA:** 1916. Hdqrs., Philadelphia, Pa. Meets, Second Thursday. PRESIDENT, M. E. Barnard, 12 S. 12th St. (7). SECRETARY, C. J. Lubking, 5060 Wayne Ave.

● **PITTSBURGH:** 1919. Hdqrs., Pittsburgh, Pa. Meets, Third Monday. PRESIDENT, B. B. Reilly, Fifth & Liberty Aves. (22). SECRETARY, E. H. Riesmeyer, Jr., 231-33 Water St. (22).

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● **ST. LOUIS:** 1918. Hdqrs., St. Louis, Mo. Meets, Second Tuesday. PRESIDENT, L. L. Hamig, 1706 Olive St. (3). SECRETARY, J. F. Naylor, Jr., 2333 S. Grand Ave. (4).

● **SHREVEPORT:** 1948. Hdqrs., Shreveport, La. Meets, Third Thursday. PRESIDENT, R. M. Hood, 411 Louisiana Ave. SECRETARY, M. A. Hudson, 4609 Gilbert Dr.

● **SOUTH TEXAS:** 1938. Hdqrs., Houston, Tex. Meets, Third Friday. PRESIDENT, C. L. Fleming, 809 M. & M. Bldg. SECRETARY, J. W. Holland, Esperson Bldg. (2).

● **SOUTHERN CALIFORNIA:** 1930. Hdqrs., Los Angeles, Calif. Meets, First Tuesday. PRESIDENT, M. C. Greiner, 1559 Club View Dr. (24). SECRETARY, L. B. Davenport, 137 S. Anderson St. (33).

● **SOUTHERN PIEDMONT:** 1952. Hdqrs. Charlotte, N.C. PRESIDENT, R. M. Warren, Jr., P.O. Box 1755, Charlotte. SECRETARY, J. A. Rice, P.O. Box 1755, Charlotte.

● **SOUTHWEST TEXAS:** 1946. Hdqrs., San Antonio, Tex. Meets, Third Tuesday. PRESIDENT, W. E. Long, Dept. of Mechanical Engrg., University of Texas, Austin. SECRETARY, L. H. Hornor, Jr., 810 Insurance Bldg.

● **UTAH:** 1944. Hdqrs., Salt Lake City, Utah. Meets, First Wednesday. PRESIDENT, D. R. Wilde, 2634 S. 19th E. (1). SECRETARY, Alfred Richeda, P.O. Box 479 (9).

● **VIRGINIA:** 1946. Hdqrs., Norfolk, Va. Meets, Third Wednesday. PRESIDENT, D. E. Phillips, P. O. Box 674, Newport News. SECRETARY, H. E. Marquart, 111 W. Main St. (10).

● **WASHINGTON, D. C.:** 1935. Hdqrs., Washington, D. C. Meets, Second Wednesday. PRESIDENT, S. R. Allen, 942 Washington Bldg. (5). SECRETARY, P. H. Loughran, Jr., 4513 49th St., N.W. (16).

● **WESTERN MICHIGAN:** 1931. Hdqrs., Grand Rapids, Mich. Meets, Second Monday. PRESIDENT, H. R. Limbacher, 760 E. Vine St., Kalamazoo. SECRETARY, F. K. Platt, P.O. Box 307, Kalamazoo.

● **WESTERN NEW YORK:** 1919. Hdqrs., Buffalo, N. Y. Meets, Second Monday. PRESIDENT, J. M. Quackenbush, 505 Franklin St. (2). SECRETARY, Q. P. Thompson, 260 Richmond Ave. (22).

● **WISCONSIN:** 1922. Hdqrs., Milwaukee, Wis. Meets, Third Monday. PRESIDENT, J. A. Lofte, 2505 N. 97th St., Wauwatosa (10). SECRETARY, I. J. Rossiter, 231 W. Wisconsin (3).

STUDENT BRANCHES

● **COLLEGE OF CITY OF NEW YORK:** 1949. Hdqrs., New York, N. Y.

● **LOUISIANA POLYTECHNIC INSTITUTE:** 1949. Hdqrs., Ruston, La. PRESIDENT, W. G. McMullen, Box 472, Tech Station. SECRETARY, R. L. Gorton, Box 184, Tech Station.

● **NORTH CAROLINA STATE COLLEGE:** 1948. Hdqrs., Raleigh, N. C. PRESIDENT, Sydney Narvey, 5-B Vetville, State College Station. SECRETARY, E. A. Travis, Jr., P.O. Box 3333, Bagwell Dormitory.

● **OKLAHOMA A. & M. COLLEGE:** 1950. Hdqrs., Stillwater, Okla. PRESIDENT, Stuart Cohen, 513 ½ Knoblock. SECRETARY, H. G. Rice, 5 Chickasha, Box 417, Vets Village.

● **OREGON STATE COLLEGE:** 1949. Hdqrs., Corvallis, Ore. Meets, First Wednesday after First Tuesday. PRESIDENT, D. W. Blair, 223 W. 15th St. SECRETARY, C. D. Cannon, 404 N. 26th St.

● **PURDUE UNIVERSITY:** 1948. Hdqrs., W. Lafayette, Ind. CHAIRMAN, N. J. Kirch, 922 Highland Ave., Lafayette. SECRETARY, H. F. Allen, Jr., 629 University St.

● **TEXAS A. & M. COLLEGE:** 1946. Hdqrs., College Station. Meets, Second and Fourth Tuesday. PRESIDENT, J. O. Kadel, Box 4054. SECRETARY, W. C. Haggard, Box 5227.

● **UNIVERSITY OF DETROIT:** 1949. Hdqrs., Detroit, Mich. Meets, First Tuesday. PRESIDENT, G. H. Williams, 18251 Washburn (21). SECRETARY, R. H. Drake, 5598 Hurlbut (13).

● **UNIVERSITY OF KANSAS:** 1949. Hdqrs., Lawrence, Kans. Address mail to Dr. Warren E. Snyder, chairman, Dept. of Mechanical Engineering, University of Kansas.

● **UNIVERSITY OF TEXAS:** 1949. Hdqrs., Austin, Tex. Meets, First and Third Tuesday. PRESIDENT, W. A. Cox, 360-D Deep Eddy Apts. SECRETARY, V. H. Miles, PHP Dorm J.

● **UNIVERSITY OF TORONTO:** 1951. Hdqrs., Toronto, Ont. CHAIRMAN, J. A. Slemin, 21 Wilberton Rd. SECRETARY, T. O. Smith, 455 Avenue Rd.

NEW!

LUNKENHEIMER
GLAND-TYPE
BRONZE NEEDLE VALVES

with fine thread-pitch
for precision throttling

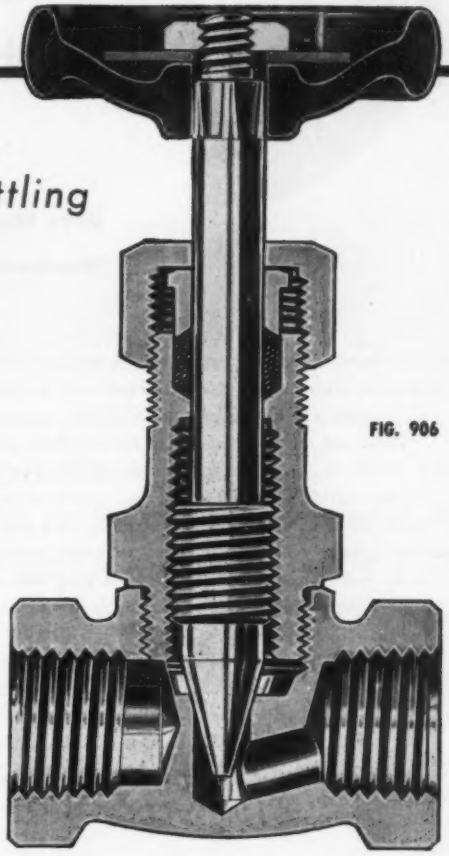

FIG. 906

• WHAT'S NEW ABOUT THEM?

They have a new gland follower . . . they're redesigned from handwheel to seat opening . . . and yet they're competitive in price with non-gland valves.

• HOW ARE THEY FOR INSTRUMENTATION?

Perfect. The handwheels lend themselves to delicate fingertip control. Fig. 1565 has a special indicator handwheel with numbered graduations and a spring lock, if you prefer. They're compact, to fit behind instrument-boards, and they have a very fine thread-pitch for close regulation. The seat angle is 30°. They handle 200 lbs. Steam; 400 lbs. W.O.G.

• HOW ABOUT THE STEMS?

Take your choice of "Stemalloy"* or steel in the globe design. "Stemalloy"* is Lunkenheimer's exclusive wear-resisting bronze alloy. Steel stems are cadmium-plated to resist rust.

• WHERE CAN YOU FIND OUT MORE?

Ask for Lunkenheimer's new Needle Valve Bulletin 568. Your distributor has it, or we'll send you a copy. Write The Lunkenheimer Company, Box 360N, Cincinnati 14, Ohio.

*Patented alloy

BRONZE • IRON • STEEL

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THE ONE *Great* NAME IN VALVES

L-512-ER

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says Wendell Westover,

Westover-Wolfe Service, Inc., Albany, N. Y.

We may be old fashioned, but we believe our customers are in business to make money. Not just to turn over dollars, but to make a legitimate profit on a decent volume of sales. That's one reason we at Bryant do everything possible to *protect your profit margin*—give you top-quality, dependable products; permit you to save on installation costs; back you with technical assistance when you need it; and finally, help you promote and *sell* the more profitable jobs. No, we don't expect our customers to be magicians—to keep up a family, and a business, on profitless turnover. If this fits with your thinking, you'll be interested in Bryant's aggressive program for '52. We're going to make money, and help *you* make money. Your Bryant Distributor will give you the facts. Or write Bryant Heater Division, Dept. 125, Affiliated Gas Equipment, Inc., 17825 St. Clair Ave., Cleveland 10, Ohio.

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Gas-Fired Boiler

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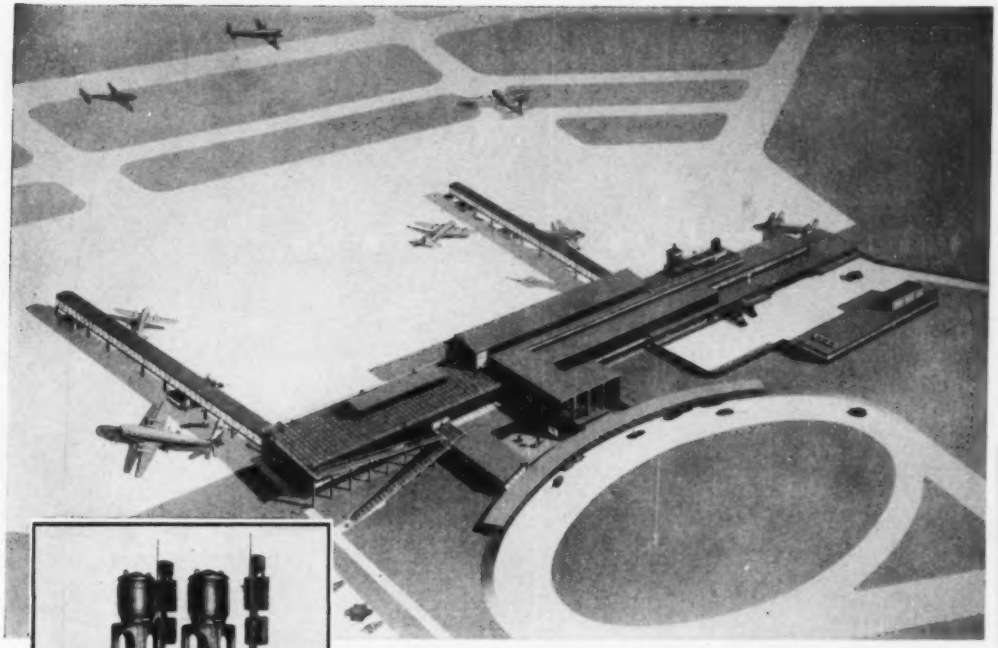
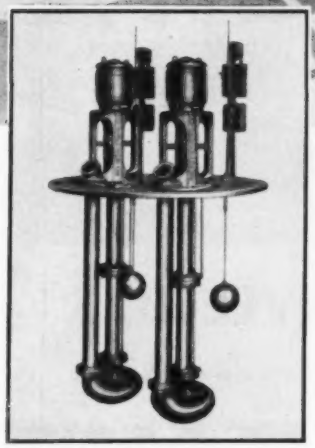
AIR CONDITIONING,
WATER HEATING



Carroll, Grisdale & Van Alen, Architects
A. E. D'Ambly, Structural Engineer — L. E. Winter & Company, Contractor



In selecting the sewage and sump pumps for Philadelphia's Airport Terminal Chicago Non-Clog Pumps were specified. The large volume of traffic with heavy peak loads at arrival and departure time made it essential that reliable, heavy duty pumps be used. The Chicago Non-Clog with a background of 43 years of rugged dependable service, was the logical choice. 28 pumps, in basins of 14 duplex sets, pump the sewage and bilge from this new and modern airport terminal.

To assure efficient and trouble-free service Engineers for Philadelphia's International Airport choose CHICAGO NON-CLOG PUMPS

—14 DUPLEX SETS—

Philadelphia's great new international airport is one of the finest in the world. The modern terminal building incorporates the latest in design and lay-out for easy and efficient handling of passenger traffic.

In planning the structure, the architects wisely provided for future growth. At the present rate of expansion it is expected that by 1960 about 613,000 passengers per year will use the terminal. Both at present and with this expected volume of traffic, Philadelphia's airport will rank among the first 20 in the country, both as to number of planes and number of passengers using the airport. Carroll, Grisdale & Van Alen, Architects. A. E. D'Ambly, Structural Engineer. L. E. Winter & Company, Contractor.

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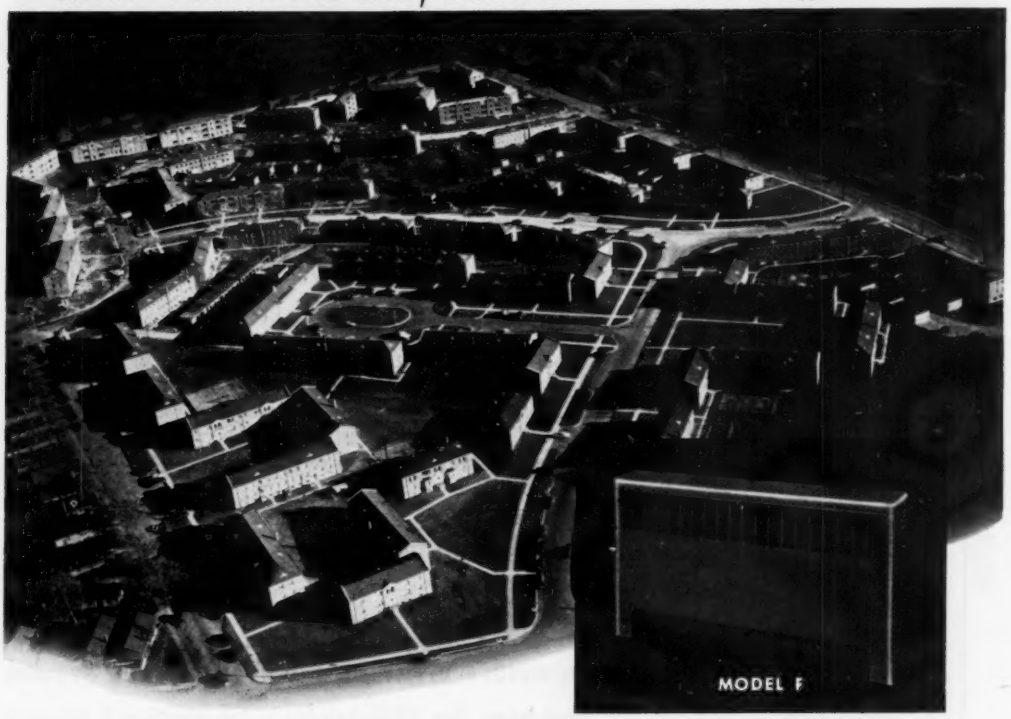

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selected to comfortably heat the 700 dwelling units of this new, self-contained residential community for Mid-America

Here Airtherm Convectors fit functionally into the handsome Colonial design, demonstrating their wide adaptability to all types of decor, from traditional to modern. Savings in labor and installation costs were made possible by Airtherm's simplicity and ease in handling and connecting.

Airtherm Convectors are available for wall, recessed, or free-standing installation.

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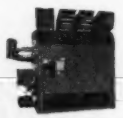
Oil or Gas Direct Fired Heaters

Horizontal Type Unit Heaters

Vertical Type Unit Heaters

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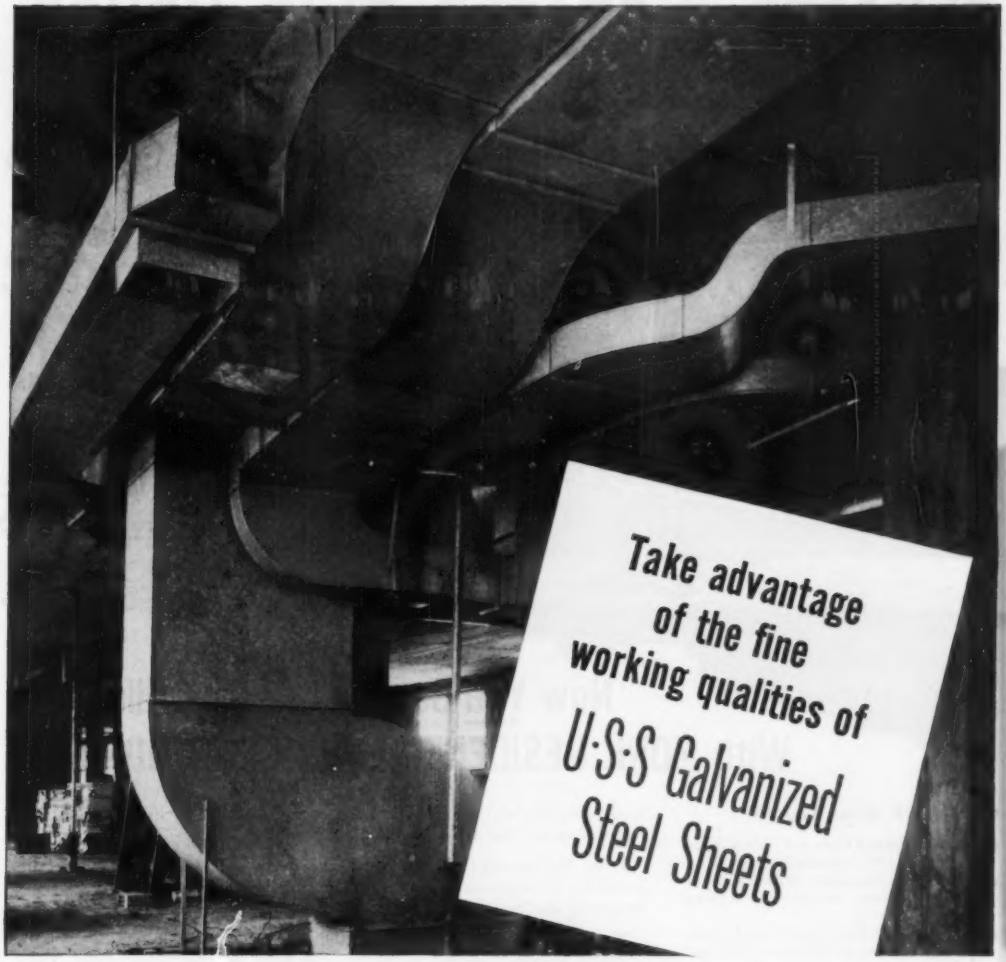

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HEADQUARTERS FOR MECHANICAL COOLING . . . SINCE 1885

Exclusive features of design plus quality controlled materials and workmanship are the reasons

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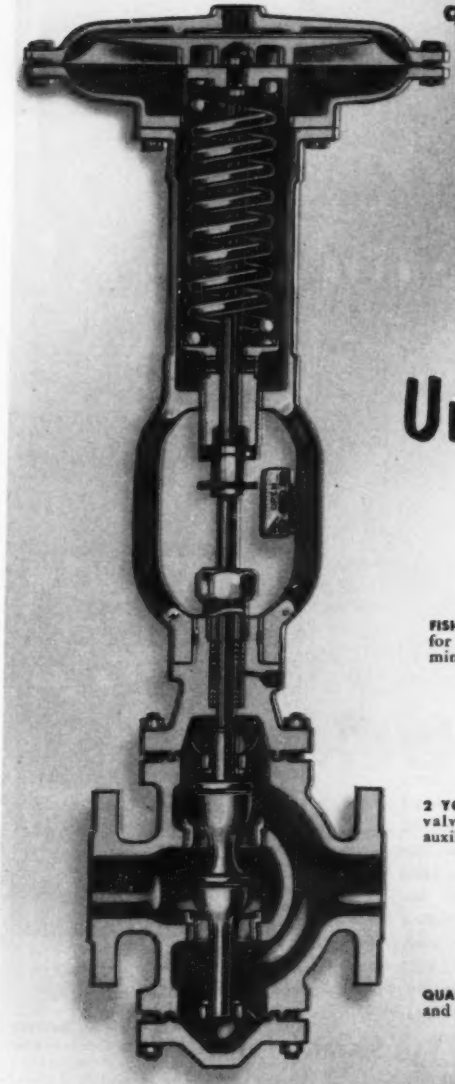
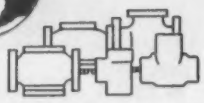
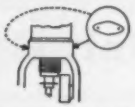
Diaphragm Motor Valves are Universally Preferred



FISHER ALLOY SPRINGS are tested for load tolerances of plus or minus 2½%.



VARIETY OF BODY TYPES and materials—iron, steel, bronze, alloys, single and double seated, angle and globe.



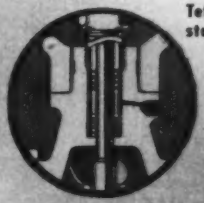
2 YOKE MOUNTING PADS for valve positioner and other auxiliary equipment.

WIDE CHOICE OF INNER VALVES to provide desired flow characteristics.

QUALITY CONTROLLED materials and workmanship.

WALL SECTIONS conform with ASA fittings code.

Fisher offers the most versatile and complete line of Diaphragm Motor Valves—manufactured to handle pressure conditions up to 6,000 pounds. Available in metals for highly corrosive service and alloys for high temperature work. They are built for your specific requirements.



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Dual Teflon packing also available. 2 sets of packing separated with bleed area where purge zone is desired. Positively prevents outbound leakage—or inbound leakage under vacuum service. For dangerous toxic, corrosive, etc. applications.

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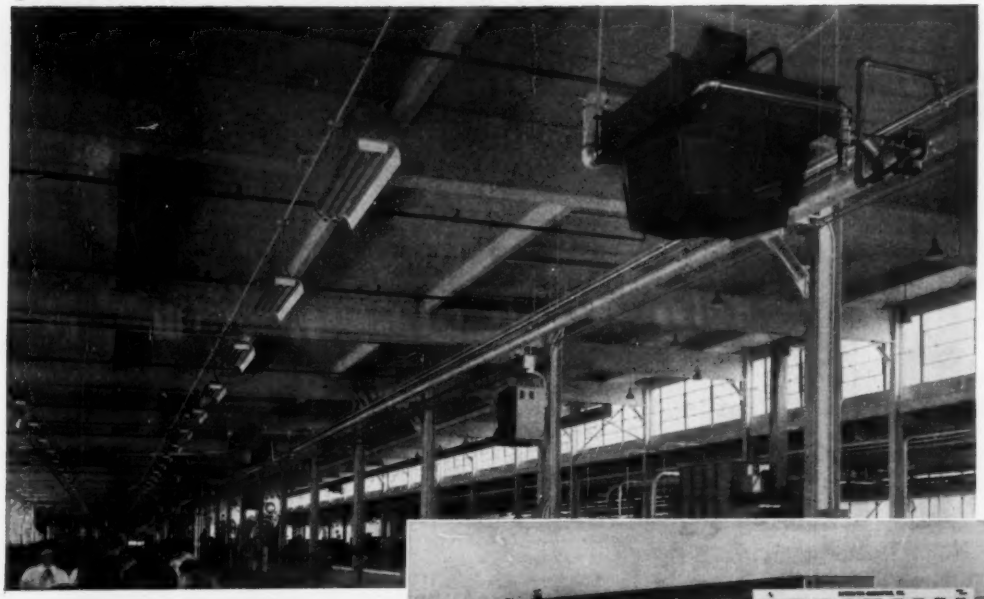

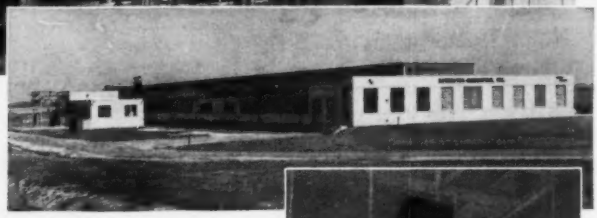

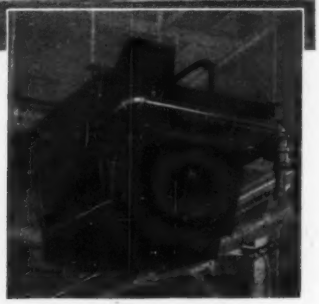

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The Crawfordsville, Indiana plant of Raybestos-Manhattan, Inc., one of the country's leading manufacturers of asbestos and rubber products is an example of a modern carefully planned industrial building, laid out for highest efficiency in manufacturing. Typical of the equipment selected with this end in view are the Wing Revolving Unit Heaters. These heaters, by distributing the heated air downwards in a constantly changing direction, keep the workers comfortably warm and invigorated, without subjecting them to constant blasts of hot air or chilly drafts. Wing Revolving Unit Heaters are worth a great deal from the standpoint of employee relations alone.

The discharge outlets of the Wing Revolving Unit Heaters revolve slowly, distributing the heated air downwards in gently moving streams, that can be adjusted for different shapes of areas to be covered. In the summer time, with the heat turned off they act as a perfect air cooling system.

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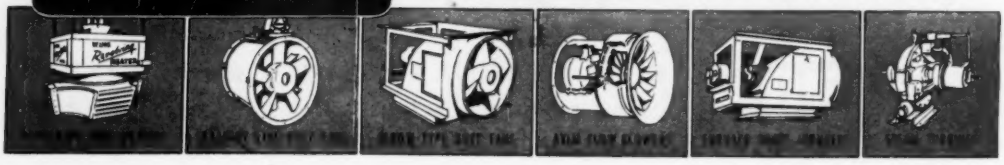

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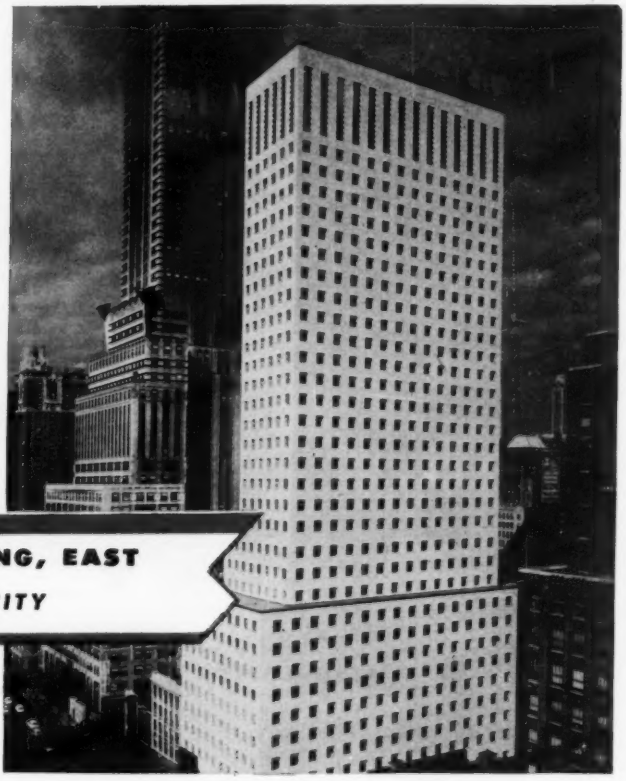

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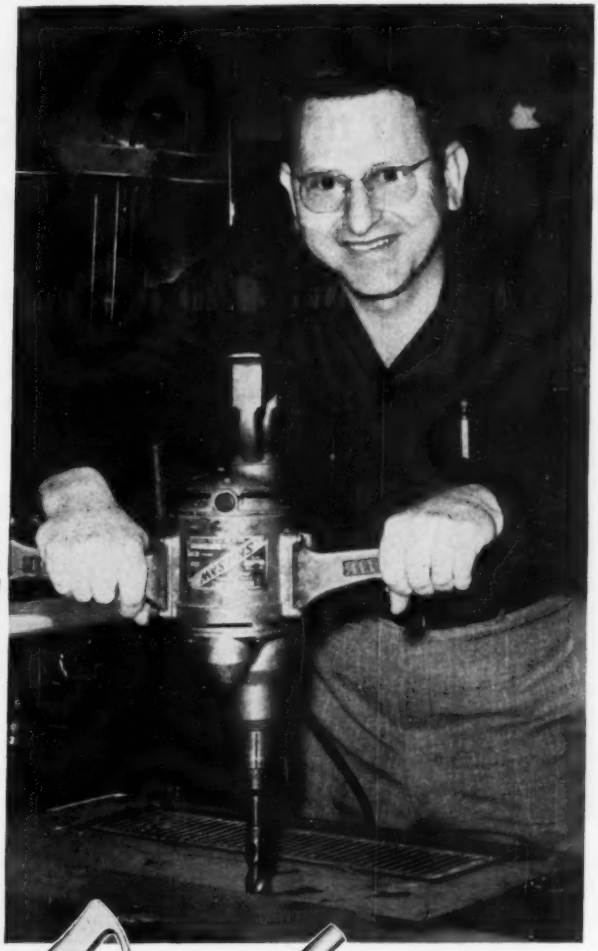
"Seven years abuse—not a penny for repairs—that's SKIL performance!"

says **Sam Rosenthal,** of the
ROSENTHAL METAL CO.
Atlanta, Georgia



"We really put a tool through its paces," says Mr. Rosenthal. "All our work is sheet metal fabrication. Much of it made to order, like this job of fitting out U.S.A.A.F. mobile canteen trucks. This means drilling in steel—*constantly!*

"For seven years, day after day, we've given this ½-inch SKIL Drill real punishment, sometimes beyond normal capacity. Yet, in all that time," he concludes, "we've never spent a *cent* on repairs. You can't beat *that* kind of quality in a drill."

SKIL Drill—Model 283

Heavy duty ½" drill. Capacity in steel: 0" to ½". Capacity in hardwood: 0" to 1½". No-load speed: 550 r.p.m. standard. 1000 r.p.m. at extra cost. Full-load speed: 360 r.p.m. standard. Bearings: Ball bearings on armature, intermediate shaft and chuck spindle. Length overall: 15". Net weight: 13 lbs.

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NEW... REDUCES ADJUSTMENT TIME and LABOR 90%

BALANCE SYSTEM WITHOUT REMOVING GRILLE

This means that plaster or paint is never damaged or smudged during balancing. Key-operator regulates air volume to hairline adjustment.

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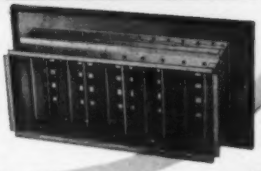
COMBINE AG-35 with any AIRFOIL grille for complete one-unit handling.

PERFECT 4-WAY AIR CONTROL
Light weight—easy to handle—easy to install.



VOLUME CONTROL LOUVERS MOVE SIMULTANEOUSLY IN OPPOSITE DIRECTIONS—CLOSE TO ANY DEGREE DESIRED FROM FULL OPEN TO FULL CLOSED

Installers balance an air-conditioning system in *one-tenth the ordinary time* with amazing, new AIRFOIL AG-35.

There are no grilles to remove. *Workman's hands never touch grille or wall to leave dirty, expensive smudges.* Blades adjust faster—easier. Close more tightly.

Louvers do not close flat as in common styles using damper but *close at 45°.* This maintains a metering control down to the final moment of closure with a minimum disturbance of the air pattern.

Remember—there is *one unit to install—one unit to handle—one unit to purchase* when the air guide volume adjuster is combined with an AIRFOIL grille.

AIRFOIL Grilles are the most efficient ever designed. They are priced to enable you to use a superior product at lower cost. Get complete information at once.

FREE

CHECK TYPE OF GRILLE ON WHICH INFORMATION IS DESIRED

- ☐ Air-conditioning outlets
- ☐ Return air grilles and registers
- ☐ Volume controllers
- ☐ Perforated metal and ornamental grilles
- ☐ Door ventilators
- ☐ Special made-to-order grilles

TITUS MANUFACTURING CORP., WATERLOO, IOWA

- ☐ RUSH information on AG-35
- ☐ Send complete catalog.
- ☐ Send literature on above checked items.

NAME_____

ADDRESS_____

CITY_____ STATE_____

Associated Architects
Skidmore, Owings & Merrill
Claude E. Naston

Consulting Engineers
Cary B. Gamble & Associates

General Contractor
George J. Glover Co., Inc.

Mechanical Contractor
Emile M. Bobst Co.

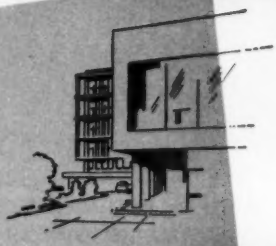
President Crawford H. Ellis' Modern Office

POWERS air conditioning control

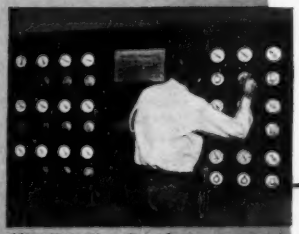
Helps Insure Maximum Comfort and Efficiency in

Famous PAN AMERICAN LIFE INSURANCE CO. Building

NEW ORLEANS, LA.



Typical Clerical Space



POWERS Air Conditioning Control Panel

In this unique louvered structure comfortable temperature and humidity conditions are assured regardless of the weather outdoors.

Employees are more efficient and alert, make fewer mistakes and turn out a better day's work in properly air conditioned work spaces.

Prominent insurance companies from coast to coast have found the year after year accuracy of dependability of Powers equipment a very profitable investment.

When problems of temperature and humidity control arise, contact Powers' nearest office. Our more than 60 years of experience gained in all types of prominent buildings may be helpful to you.

THE POWERS REGULATOR CO., SKOKIE, ILLINOIS

OFFICES IN OVER 50 CITIES

SEE YOUR PHONE BOOK

(a82)

Church buys steel pipe radiant heating to keep summer warmth all winter

Steel pipe radiant heating panels installed in Trinity Congregational Church, Pepper Pike, Ohio. Humal Construction Co., general contractor; Barlow Plumbing and Heating Company, heating contractor. Ward and Conrad, architects.

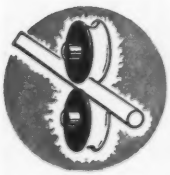
Churches and other large-area structures are among your best prospects for radiant heating systems made with Republic Steel Pipe. Steel pipe radiant systems are equally suited to home heating needs—especially for new slab-on-ground types. Good for snow-removal systems, too.

As you know, steel pipe has been widely used for closed hot-water circulating systems for many years. When properly installed, it gives years of trouble-free service, proving you need nothing more costly than Republic Steel Pipe for today's radiant heating panels.

You'll find today's Republic Steel Pipe highly ductile and easy to fabricate . . . just right for the close coiling and bending which radiant panels require. It threads cleanly, and welds readily by all modern methods.

Why not check with your Republic Pipe Jobber now about steel pipe for the radiant heating and snow-melting jobs you'll line up for this year? He'll be glad to give you latest information about available sizes and current deliveries.

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Bldg., New York 17, N.Y.



REPUBLIC CONTINUOUS WELD PIPE

Easy to bend, thread and close coil
Easy to weld by all methods
Uniformly ductile
Uniformly strong
Uniformly clean and scale-free
Uniform wall thickness, diameter, concentricity
Economical uniform lengths, extra long lengths
Expansion co-efficient same as concrete and plaster

"HOP IN--THERE'S PLENTY OF HOT WATER SINCE POP HAD CORROSION-RESISTANT READING COPPER TUBING INSTALLED!"

Today, of course, much of our production of long-wearing Reading Copper Tubing is earmarked for essential defense orders. But, you can count on our continued cooperation to keep you supplied with as much tubing for civilian use as government restrictions permit.

READING COPPER TUBING

READING TUBE CORPORATION

Producers of Reading Lektroneal Copper Tubing and Reading 85% Grade A Red Brass Pipe

OFFICES AND EASTERN DISTRIBUTION DEPOT:
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• READING, PA. • HOUSTON, TEXAS: 1121 Rothwell St.
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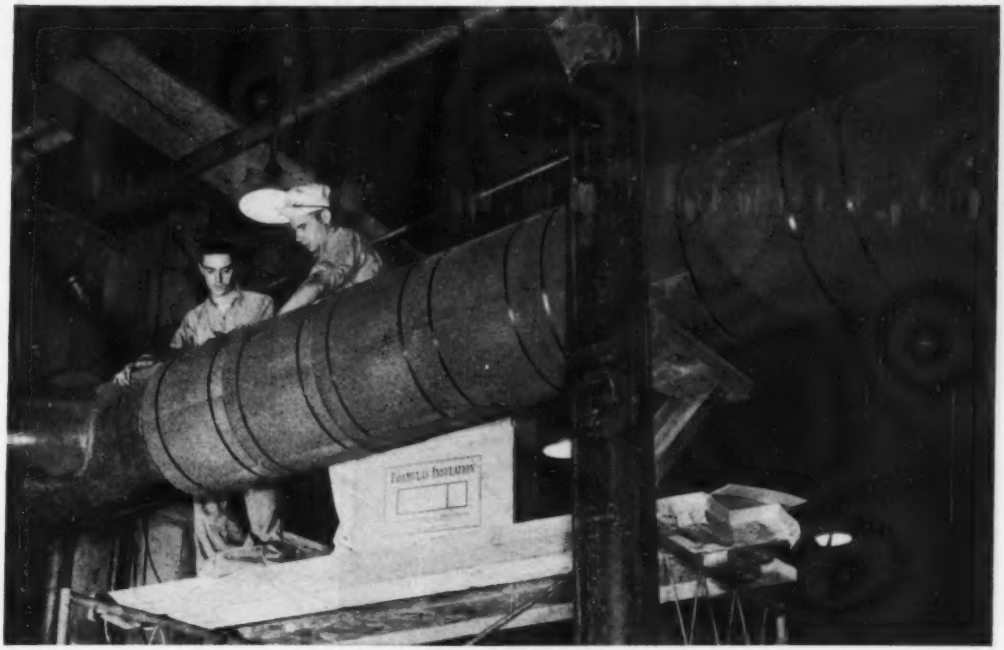
Photo of FOAMGLAS being installed on chill water lines at the new Gateway Center in Pittsburgh, Pa. Finish will be applied later on the FOAMGLAS. Owner: Equitable Life Assurance Society of the U.S.; Architects: Board of Design, Equitable Life Assurance Society of the U.S. and Haffman & Crumpton, Pittsburgh, Pa.; General Contractor: Starrett Brothers & Eken, Inc., New York City; Insulation Contractor: Richmond Asbestos Co., Inc., Long Island, N.Y.



This insulation laughs at water . . . it's FOAMGLAS!

● In Pittsburgh, the new Gateway Center Buildings furnish chilled water to all tenants for air-conditioning. Chilled water lines, fittings and valves are insulated with FOAMGLAS—one insulation that you can be sure won't absorb water, become soggy and thereby lose its insulating efficiency.

Remember that if water vapor penetrates halfway into an ordinary insulation, you actually lose a large part of your insulation value. Compare this to FOAMGLAS. Even without a protective coating of any kind, FOAMGLAS will not absorb water because it is *all glass*. Every block of FOAMGLAS contains millions of tiny, separate air bubbles. It is this cellular glass construction that slows the heat flow, and *stops* the water.

Send the coupon and we'll mail you a free sample of FOAMGLAS and our latest booklets.

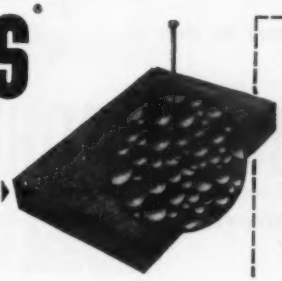
PITTSBURGH CORNING CORPORATION · PITTSBURGH 22, PA.

PITTSBURGH PC CORNING

FOAMGLAS®

the cellular glass insulation

The *best* glass insulation is cellular glass. The *only* cellular glass insulation is FOAMGLAS. This unique material is composed of still air, sealed in minute glass cells. It is light weight, incombustible, vermiproof. It has unusually high resistance to moisture, chemicals and many other elements that cause insulation to deteriorate.



Pittsburgh Corning Corporation
Dept. AF-82, 307 Fourth Avenue
Pittsburgh 22, Pa.

Please send me, without obligation, a sample of FOAMGLAS and your FREE booklets on the use of FOAMGLAS for: Normal Temperature Commercial, Industrial and Public Buildings ☐ Refrigerated Structures ☐ Piping and Process Equipment ☐.

Name.....

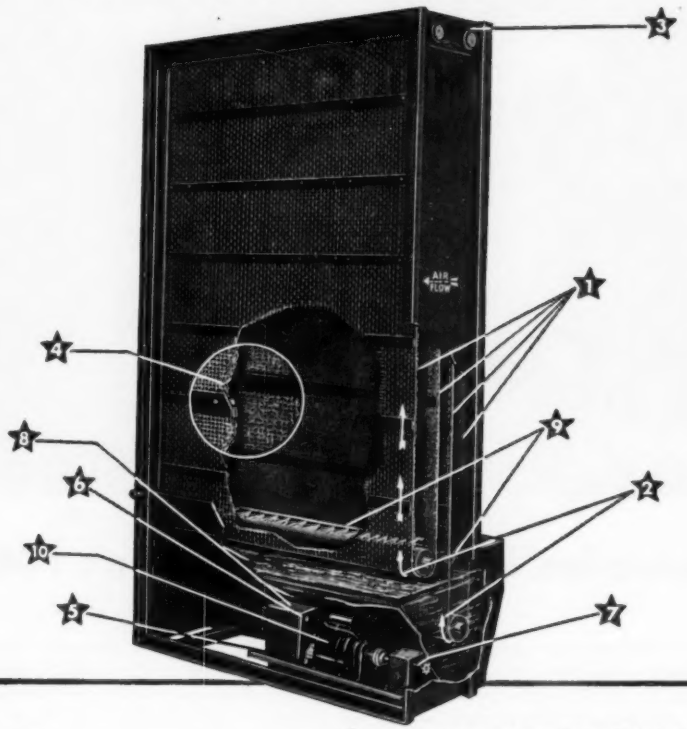
Address.....

City.....State.....

STAYNEW AUTOMATIC

No other Air Filter can give you these

10 IMPORTANT FEATURES

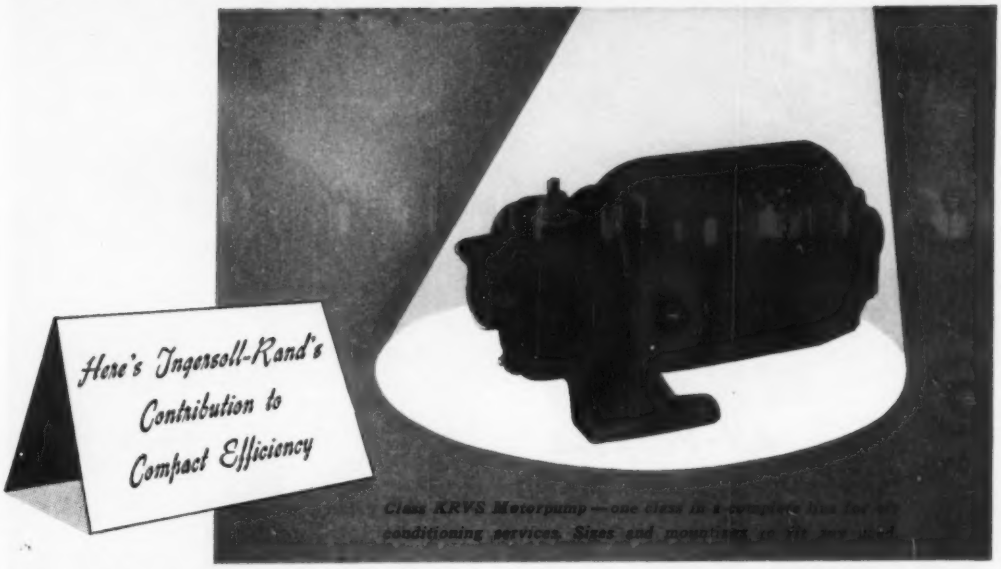


1. **Double Filter Curtains.**
2. **Direction of Curtain Travel such that *cleaned* panels are *always* on downstream or filtered air side.**
3. **Gear and Roller Chain Drive. *No belts to slip.***
4. **Highest Efficiency of any mechanical type self-cleaning filter plus exceptionally large dust-handling ability.**
5. **Motor and Control Unit mounted on *clean* air side of filter.**
6. **Momentary Contact Time Switch for testing and checking curtain travel and compressed air control.**
7. **Shear Pin Protection of moving parts from accidental damage.**
8. **Control Mechanism arranged as an integral part of filter unit or for remote mounting.**
9. **Compressed air curtain cleaners available for special conditions.**
10. **Nation-wide Service on both motor and controls.**

DOLLINGER CORPORATION

9 CENTRE PARK DOLLINGER PROTECTOMOTOR STAYNEW FILTERS **ROCHESTER 3, N. Y.**

SMALLER UNITS and PUMPS



Class KRVS Motorpump—one class in a complete line for air conditioning services. Sizes and mountings to fit your plans.

the New emphasis in Air Conditioning

Everywhere the emphasis is on compact efficiency for air conditioning units and pumps. Take a peek at the plans on the tables of Design Engineers working on new models. You'll find that in drawing after drawing, units and pumps are getting smaller and more compact than ever before!

The I-R Motorpump brings future pump design to you now. And it's now, today, that you can get all the advantages of future design benefits! Here are a few of these advantages:

● *SIZE FOR SIZE—the I-R Motorpump will outperform any pump now available for air conditioning service.* ● *SPACE SAVING—The compactness of the I-R Motorpump will make you wonder why it couldn't have been designed years ago!* ● *EASY INSTALLATION—Operates equally well in any position. Easily bolted to floor, wall, or equipment. No special foundations needed.* ● *LONG, TROUBLE-FREE SERVICE—Put in these rugged pumps and forget them!* ● *LOW FIRST COST—Use a smaller, more efficient I-R Motorpump to do the job of a larger regular pump.*

For complete details write for Bulletin 7177 or call the nearest Ingersoll-Rand branch office.

AVAILABLE NOW FOR RUSH DELIVERY

Ingersoll-Rand MOTORPUMPS for Improved Air Conditioning Operation

Ingersoll-Rand

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an ACCO product

NEW All-Purpose Gate Valve

• Use it for hot and cold water lines or low pressure steam—in plumbing, heating, and air conditioning systems—in homes, apartments, restaurants, offices, stores, hospitals, industrial plants.

The strong, amply-sectioned body will not distort nor will seat warp under soldering temperatures. The R-P&C Bronze Solder End Gate Valve has full, unobstructed flow. For use with K, L, and M copper tubing. Working pressures: steam —125 lbs.; cold water, oil, or gas (non-shock)—200 lbs.

Your R-P&C distributor has them—or can get them for you. Your nearest R-P&C district office will gladly furnish details of this and other R-P&C Valves. Call your distributor or write us today.

No. 90 R-P&C Bronze Solder End Gate Valve

R-P&C valves

ACCO

TRADE MARK

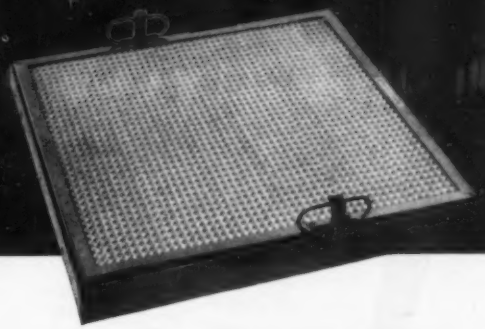
R-P&C VALVE DIVISION
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Baltimore, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

SAVE TIME AND LABOR

with CONTINENTAL

E·Z·Wash AIR FILTERS



Quickly Cleaned... Easily Re-oiled!

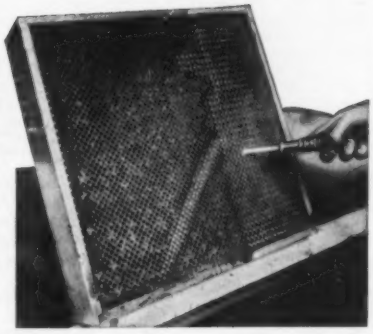
CONTINENTAL *E·Z·Wash* filters are *the only cleanable air filters which require no hot water, detergents or special cleaning tanks.* Cold water under normal line pressure . . an ordinary garden hose and spray nozzle . . are all that are needed for easy, rapid and efficient cleaning. You save with CONTINENTALS.

After cleaning, CONTINENTAL *E·Z·Wash* filters can be re-oiled very quickly and easily. Charge CONTINENTAL filters by dipping them or by spraying with any commercial, air operated oil-spray gun. For either method use CONTINENTAL C-5 filter oil.

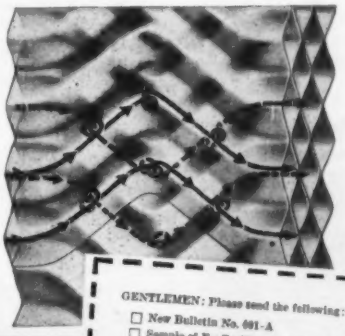
Continental *E·Z·Wash* filters are available in capacities from 950 to 1850 CFM . . in a range of standardized sizes.

Low maintenance is a major advantage in CONTINENTAL *E·Z·Wash* filters. High efficiency in air cleaning and low resistance to air flow are further advantages of these remarkable filters which save time and labor.

Write for full details today!



TOP: Convenient latchhandles facilitate quick removal of Continental E • Z • Wash unit filters for cleaning.



ABOVE: The E • Z • Wash unit filter can be quickly and thoroughly cleaned with an ordinary hose using cold water.

LEFT: Cross-section diagram of Continental patented filter media showing turbulent air flow, which results in extremely high air-cleaning efficiency and continuous exceptionally low resistance.

GENTLEMEN: Please send the following:

☐ New Bulletin No. 601-A

☐ Sample of E • Z • Wash Air Filter Media

NAME _____

FIRM _____

STREET _____

CITY _____ STATE _____

CONTINENTAL AIR FILTERS, Inc.

P. O. BOX 1647 • LOUISVILLE 1, KY.

The C-E re-circulation Steam Generator

is convenient . . . reliable . . . compact . . . economical . . . fast, says Mr. Loy

LOY-LANGE BOX COMPANY
828 RUSSELL AVENUE
ST. LOUIS 4, MISSOURI

May 14, 1952.

Combustion Engineering - Superheater, Inc.,
5319 Shreve Avenue,
St. Louis 15, Missouri.

Attention: Mr. W. J. Woodruff
District Manager

Gentlemen:

A little over a year ago we installed in our plant a C.E. Re-circulation Steam Generator. This unit, rated at 4,000 pounds steam per hour at 150 Psi., serves a 63 inch corrugating machine and a heating load of approximately 50 H.P. Your steam generator has handled the load with ease. The unit has been in practically continuous operation, the only interruption being for routine maintenance and one or two service operations of a minor nature.

We like this unit and are pleased to give it our sincere recommendation. It has proved to be a reliable source of high pressure steam. It follows our extremely fluctuating load condition without drop in steam pressure. It is extremely compact in relation to amount of steam delivered. The installation has enabled us to use considerable of the floor space formerly occupied by previous installation of fire tube boilers. Fuel economy is worthwhile since it is efficient while in operation and there are no banking losses. The unit can be brought up to full operating condition from a cold start in just a few minutes.

In purchasing this equipment from your company, we were influenced by the manifest quality of the product indicated by our visual inspection and by the reputation of your company for adequate service. Both the reputation of service have lived up to our expectation. We believe the Re-circulation Steam Generator is an advanced design for steam generation in small units, and we wish you all success in the promotion of your product.

Yours very truly,

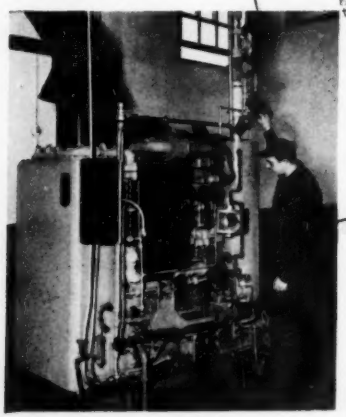
LOY-LANGE BOX COMPANY

S. K. Loy
President

REC'D MAY 16 1952 Combustion Engineering Co. St. L. Sales

SKL:fs

This is the installation to which the letter refers



C-E

COMBUSTION ENGINEERING—SUPERHEATER, INC.

200 Madison Avenue, New York 16, N. Y.

B-597

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

Here's the ECONOMICAL Way to KEEP AIR FRESH In Factories, Hospitals, Department Stores, Hotels

Sensational NEW AIREACTOR*

GYROSTATIC EVAPORATOR SPACE DEODORIZER

*Formerly Famous As "Renovair"

Works on Thrifty, Efficient Vapor Principle!

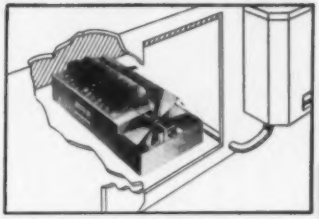
No Wicks! No Pumps! No Motors! No Mechanical Operating Costs!

Ordinary mechanical deodorizers can be costly to install, costly to operate and costly to maintain. Not so with Aireactor Gyrostatic Evaporator! This amazing new kind of space deodorizer fits quickly and easily *inside* any mechanical ventilator, adiabatic cooler or home winter air conditioner. And, once installed, it can practically be forgotten! For its power is derived from the air stream of the conditioning unit, itself. Thus, there's no motor to clog or burn out . . . nothing to repair or replace. Costs nothing whatever to run!

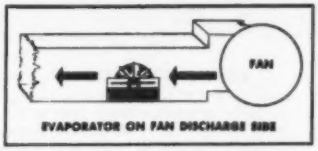
AIREACTOR KILLS HARSHEST ODORS WITHOUT PERFUME. Gyrostatic Evaporator releases vapors that neutralize indoor odors much the same as masses of green foliage freshen air outdoors. So effective, Aireactor ends even harsh paint and smoke smells. Yet there's no obnoxious "perfumey" odor of its own. No *formaldehyde*. Will not burn, will not harm the sense of smell.

INCREASES COMFORT AND PRODUCTION. Clean, pleasant air from Aireactor attracts customers into stores, restaurants and recreation centers. And, in factories and other business buildings, it helps keep employees both happy and efficient. *Can actually pay for itself in increased production!*

Flexible, too! Aireactor performs perfectly from spray guns, fogging machines or from 12-ounce wick bottle for limited spaces. To end your air conditioning headaches . . . write for further information about amazing Aireactor and the economical Gyrostatic Evaporator today!

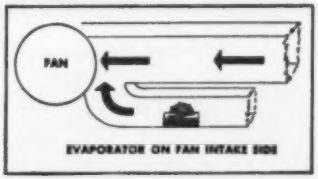


EASY TO INSTALL!
Aireactor Gyrostatic Evaporator fits *inside* the air conditioning duct. Quick, simple to place in position. No special tools or equipment required.



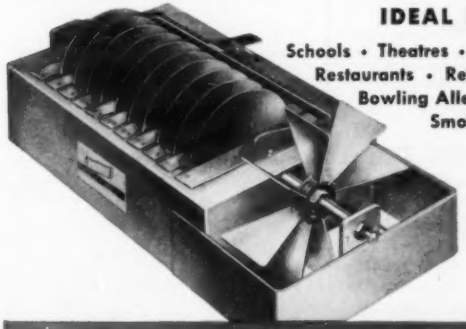
EVAPORATOR ON FAN DISCHARGE SIDE

NOTHING TO CLOG!
Power is supplied by air stream. No intricate parts to clog up. (Above illustration shows how to install on discharge side of fan.)



EVAPORATOR ON FAN INTAKE SIDE

NOTHING TO BURN OUT!
No motor of its own to get out of order. No drain on electricity or other fuel. Cost-free and simple in operation as a windmill. (Above illustration shows how to install on fan intake side.)



IDEAL FOR:

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Smoke Odor Counteraction
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Please send me AIREACTOR Information Folder *at once!* I'm interested in full details.

Name.....
Firm.....
Address.....
City.....Zone.....State.....

THESE MODERN STEAM-PAK * GENERATORS

FEATURES WILL SAVE YOU THOUSANDS

FORCED DRAFT BLOWER

Room air at 70° is blown into the front of the boiler to produce forced draft at the lowest h.p. per volume air. This method also eliminates mechanical maintenance found with induced draft type fans.

BURNER AIR COMPRESSOR

Fuels are atomized at the burner nozzle by using compressed air which breaks up completely all the various grades and types of residual oils into gases, assuring easier start and more efficient combustion.

COMBUSTION CHAMBER

Preformed carborundum blocks—factory designed and built—are used in the making of the combustion chamber due to its high heat transfer, dependability and long life with easier maintenance or replacement.

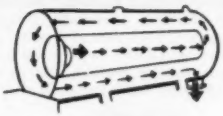
OF DOLLARS A YEAR ON STEAM COSTS

SWIRLING FLAME

High speed flame travel with exceptionally high heat transfer is obtained by a unique air injection mechanism that swirls the flame around the combustion chamber but keeps loose flames from impinging chamber.

TARGET RING

Located in an intermediate position in the combustion chamber is a carborundum ring that reforms the flame by squeezing it, drawing the outer circle of pre-heated air into the center of the flame.



THREE PASS

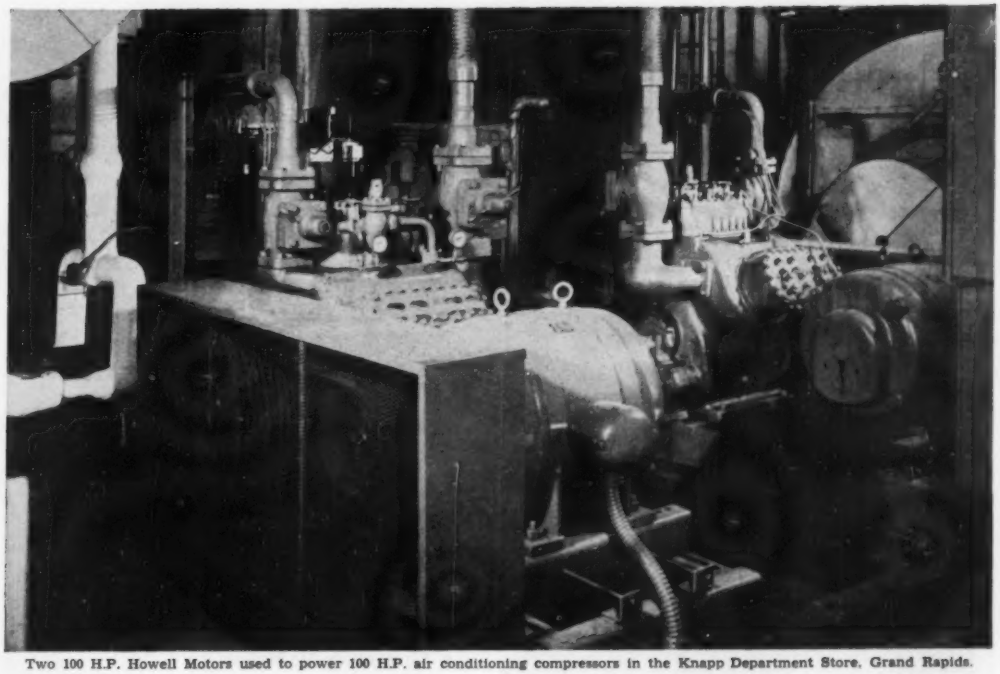
Maximum absorption of heat of combustion by the boiler water is obtained as the gases pass through the combustion chamber (1st pass), the top bank of tubes (2nd) and the bottom bank of tubes (3rd).

* With the exclusive Iris Shutter and Metering Oil Pump which automatically regulate air and oil flow to load requirements, York-Shipley Steam-Pak Generators are the most efficient on the market today. Available in a complete range of sizes from 15 to 300 h.p. for all grades of fuel oil or gas or a combination of gas and oil, these Steam-Paks save their users many thousands of dollars a year.

GET THIS BOOK TODAY!

"Steam in a Package"—
a 14-page book which tells the installation and operating advantages of York-Shipley Steam-Pak Generators.
Write today for your free copy of Bulletin 201.

Steam-Pak Generators—A Product of York-Shipley, Inc., York, Pa.

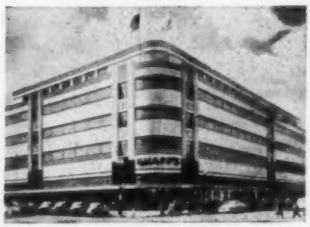


Two 100 H.P. Howell Motors used to power 100 H.P. air conditioning compressors in the Knapp Department Store, Grand Rapids.

Unusual load conditions handled with ease by HOWELL MOTORS

The Knapp Department Store in Grand Rapids is one of the most modern buildings of its type in central Michigan. Of course, it's completely air-conditioned.

This air conditioning system has a refrigeration capacity of 400 tons and handles 200,000 cubic feet of air per minute. The system is divided into numerous zones controlled through a blow-through



Knapp's, Grand Rapids' largest, most modern department store.

system. This assures maximum customer comfort in the various departments of the store, with a very minimum temperature differential.

Two 100 H.P. Howell Motors were installed on this job. Mr. D. I. Williams, president of the Don Williams Corporation, designers and installers of air conditioning systems, says, "These Howell Motors have had a full schedule of operation under unusual load conditions. Neither extreme loading during tests nor torrid summer heat has caused breakdowns or service troubles. We are glad to recommend Howell Motors."

Manufacturers of air handling and conditioning systems, as well as many other air conditioning contractors like Mr. Williams, install precision-built Howell Motors to minimize the cost and frequency of service calls and insure customer satisfaction.

Howell Open, Drip-proof Motor—the type used to power the air conditioning system at Knapp's.

Call the Howell representative in your city for facts on how Howell Motors can improve *your* installations. Call today— you'll get prompt attention.

HOWELL Red Band MOTORS

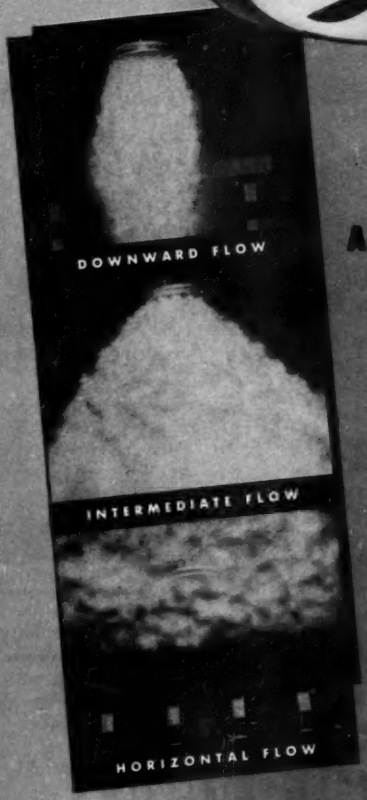
HOWELL MOTORS

HOWELL ELECTRIC MOTORS CO., HOWELL, MICHIGAN

Precision-built industrial motors since 1915

ANNOUNCING THE NEW

Fuseair Type "A" CEILING OUTLET



- Adjustable Air Pattern
- Adjustable Air Volume
- Circulatory Air Motion
- Air Mixing by Induction
- Draftless Diffusion

A NEW DIFFUSER WITH A NEW TWIST!

VORTEX FLOW, variable air pattern, volume damper and induction mixing are all features of the new Type A FUSEAIR ceiling outlet—an exclusive development of Aladdin Heating Corporation.

The Type A FUSEAIR splits the supply air into separate air streams with separate "surfaces" and discharges it into the room through multiple, radial slots affecting a high rate of "mixing by induction" and at the same time creating a slow, continuous air motion throughout the area of throw, thereby eliminating stagnate air pockets.

The adjustable feature of the Type A FUSEAIR is of exclusive design. A turn of only 11 ½° is required to change the air pattern from horizontal to vertical flow—with an unlimited number of intermediate angles of discharge in between. Units are provided with 100% volume damper and an integral part of the unit.

Units will function equally well when mounted on high or extremely low ceilings. They may be mounted flush or to exposed ductwork. When connected to exposed ductwork the unsightly connecting neck is eliminated.

Write for complete data

ALADDIN HEATING CORPORATION
2272 SAN PABLO AVENUE - OAKLAND 12, CALIFORNIA

LADISH

Controlled Quality

PIPE FITTINGS

maximum service assured by metallurgical soundness

Sound metallurgy . . . the result of unsurpassed facilities and advanced laboratory controls . . . provides the maximum of dependability in Ladish Controlled Quality fittings. Every phase of metal quality . . . composition, structure and physical properties . . . is continuously safeguarded—and certified proof of metallurgical integrity is available to users of Ladish fittings.

TO MARK PROGRESS

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

LADISH CO.

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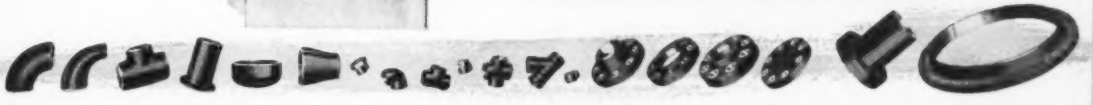


There are 4 sides to this heater's story

This is the Carrier Four-way Directed-flo Unit Heater vertical discharge model 46S.

★ It will deliver quick heat from all 4 sides . . . in any one direction or in all 4 directions, or in any combination between.

★ It will deliver quick heat at any angle, up or down.

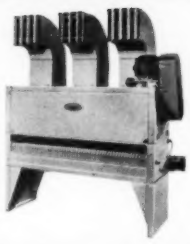
★ It will deliver quick heat in any quantity, in any direction.

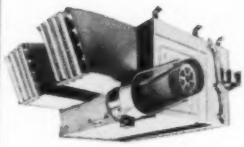
★ It's a completely flexible unit heater. Its air discharge can be adjusted to handle any new set of conditions.

★ It uses steam or hot water. And it comes in 7 sizes with capacities from 82,000 to 500,000 Btu's. Carrier Corporation, Syracuse, New York.

Carrier blower type Heat Diffusers

Models 46P, Q, R: floor, wall or ceiling mounted, for heating and ventilating large enclosed areas. Sectionalized for easy rearrangement. Available in 6 sizes to 2,390,000 Btu's per hr. at 2-lb. steam. Air-handling capacities to 31,000 cfm. Steam or hot water.





Carrier propeller-fan type Unit Heaters

Horizontal discharge model 46U (left) uses steam or hot water, comes in 10 sizes, from 21,000 to 200,000 Btu's. Gas-fired model 46T (right) has one-piece heat exchanger and combustion chamber of Aluminized Steel. (There's a duct type gas-fired model, too.) AGA-approved for all types of gas. 7 sizes, from 70,000 to 230,000 Btu's.

Carrier

AIR CONDITIONING
REFRIGERATION
INDUSTRIAL HEATING

How these K&M insulations keep heat under power's "thumb"

THE PICTURE ABOVE, taken in a large Eastern power station, is good, but it can show only the "skin-deep" beauty of the Keasbey & Mattison Insulations on the feed water deaerator in the background and the duct in the right foreground. Under the glistening surfaces, finished tightly with K&M Insulating Cement, lies this interesting heat-keeping story.

On the feed water deaerator, the "defense in depth" against heat loss is provided by K&M Hy-Temp Blocks, 1½" thick, covered with "Featherweight" 85% Magnesia Blocks, 1½" thick...an ideal combination that makes the most of the high heat-resisting qualities of Hy-Temp and the high insulation value of "Featherweight" 85% Magnesia. Alone, "Featherweight" 85% Magnesia is good for temperatures up to 600° F. (on the duct shown it is more than sufficient); its combination with Hy-Temp provides efficient insulation from 600° to 1900° F.

These K&M Insulations are practical, economical, and durable. The insulating properties of "Featherweight" 85% Magnesia are not affected by alternate heating and cooling . . . by wetting and drying . . . and, being mineral in nature, will not burn. Both insulations are supplied in appropriate forms and thicknesses for all equipment surfaces and piping.

Your K&M distributor, who is an experienced applicator, will give you full information. Or write us direct.

Nature made Asbestos...

Keasbey & Mattison has made it serve mankind since 1873

KEASBEY & MATTISON

COMPANY • AMBLER • PENNSYLVANIA

Packaging a "wonderdrug" under completely sterile conditions. Copper and brass play an important part in equipment.

"Wonder Drug" production

highlights vital role of

Powerful antibiotics produced from mold cultures have been perfected which are proving highly effective in combating blood poisoning, virus and bacterial pneumonia, whooping cough, strep throat, typhus and many other diseases which have plagued humanity for centuries. Sterile conditions and purity are constants which are maintained in their manufacture largely through specialized equipment which is highly dependent upon copper and copper base alloys. Pumps, compressors, after-coolers, evaporators, distillation towers and many other types of equipment used in the process depend upon the corrosion resistance, high thermal conductivity or inertness of copper and copper alloys. In vital roles such as these, HUSSEY COPPER plays an important part . . . one of America's most distinguished commercial metals since 1848.

HUSSEY COPPER and Brass

C. G. HUSSEY & COMPANY
(Division of Copper Range Co.)
ROLLING MILLS AND GENERAL OFFICES
PITTSBURGH 19, PA.

7 Convenient Warehouses to serve you:

PITTSBURGH (19) 2850 Second Avenue
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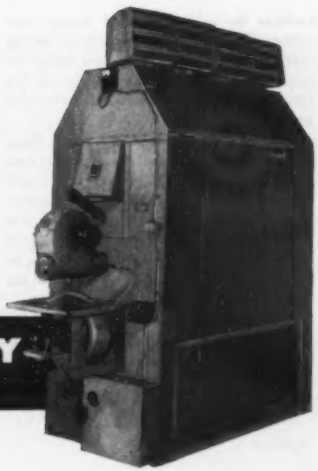
NEW YORK (13) 140 Sixth Avenue
CHICAGO (18) 3900 N. Elston Avenue
ST. LOUIS (3) 1620 Delmar Boulevard
PHILADELPHIA (30) 1632 Fairmount Avenue
CINCINNATI (2) 424 Commercial Square

Which drink will be the colder?

The obvious answer is — the one with the most ice cubes.
And with heat the same theory holds true — The more heat transfer surface, the greater the BTU output from a given amount of burning gases.
It is also an indisputable fact that the amount of heat transfer surface of an Olson Heater gives long life and more efficiency than ordinary heaters.
A modern Olson Direct Fired Heater gives even greater heat transfer surface than demanded by the most exacting heating authorities.

If you need an efficient, long-lifed heater, then you need an Olson Heater.



ARTHUR A. OLSON & COMPANY
BROAD ST. CANFIELD OHIO

Write for complete information and engineering data.

JENKINS PRACTICAL PIPING LAYOUTS 61

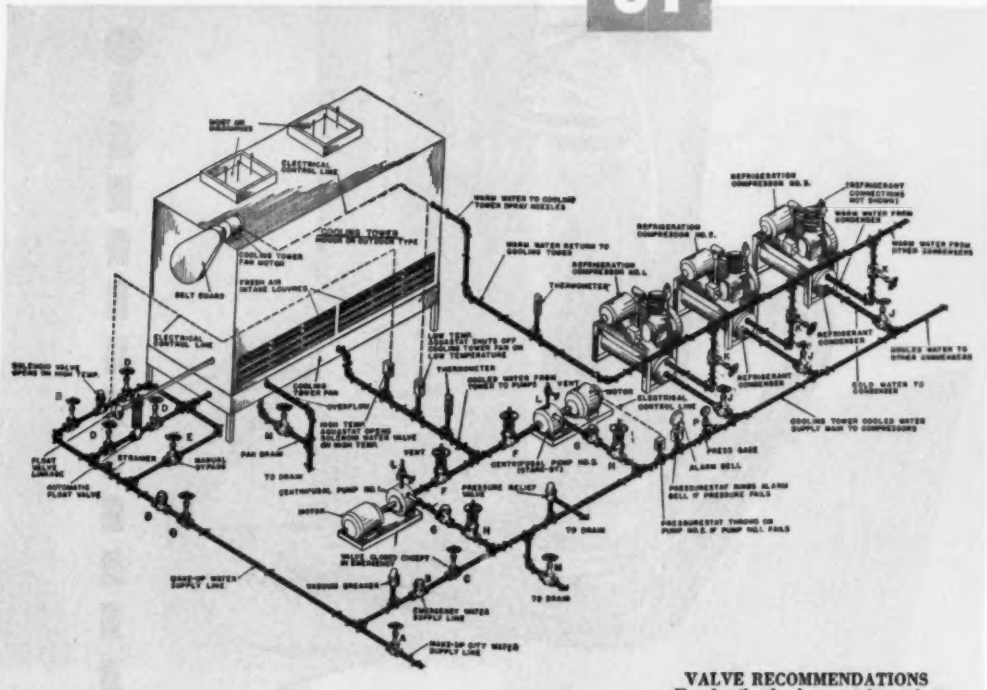


Diagram by Huxley Madeheim Consulting Engineer

COPYRIGHT, 1952 — JENKINS BROS.

How to plan a COOLING WATER SYSTEM FOR REFRIGERATION COMPRESSORS

Facilities for cold storage of frozen and perishable foods in super markets, hotels, restaurants and institutions are being expanded rapidly, creating a demand for small refrigeration compressors like the one illustrated.

In this cooling system provisions have been made to cope with all emergency conditions. These include piping for re-use and conservation of water. Moreover, should temperature of the water in the system rise above normal, fresh water is automatically introduced through a solenoid valve operated by a thermostat in the supply line.

Duplicate water circulating pumps insure continuous cool water supply to compressors since water-pressure failure in one automatically cuts in on the standby pump. To provide for the remote possibility of both pumps failing, an alarm system warns operator to turn on the emergency manually-controlled water supply.

Consultation with piping engineers is recommended when planning any major piping installations.

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering, select all the valves you need from Jenkins complete line. It's your best assurance of *lowest cost in the long run.* Jenkins Bros., 100 Park Ave., New York 17; Jenkins Bros., Ltd., Montreal.

COMPLETE DESCRIPTION AND ENLARGED DIAGRAM OF THIS LAYOUT FREE ON REQUEST. Includes additional detailed information. Ask for Piping Layout No. 61.

VALVE RECOMMENDATIONS
For details of valves to suit varying conditions, see Jenkins Catalog.

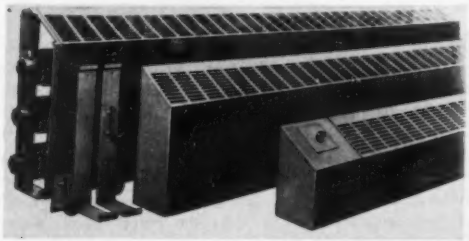
Code	Quan.	Jenkins Valves	Services
A	1	Fig. 47 Bronze Gate	Main Water Supply Shutoff
B	2	Fig. 352 Swing Check	Prevent Backflow
C	1	Fig. 47 Bronze Gate	Emergency Water Supply Shutoff
D	4	Fig. 47 Bronze Gate	Automatic Valve Shutoff
E	1	Fig. 106-A Bronze Globe	Manual Bypass of Automatic Valves
F	2	Fig. 368 Bronze Gate	Pump Suction Shutoff
G	2	Fig. 352 Br. Swing Checks	Prevent Backflow to Pumps
H	2	Fig. 368 Bronze Gate	Pump Discharge Control
J	3	Fig. 106-A Bronze Globe	Control Water to Condensors
K	3	Fig. 370 Bronze Gate	Condensor Discharge Shutoff
L	2	Fig. 743-G Bronze Needle	Pump Vent Control
M	2	Fig. 106-A Bronze Globe	Drain Valves
P	1	Fig. 743-G Bronze Needle	Pressure Gage Control
Q	1	Fig. 47 Bronze Gate	Make up Supply Line

JENKINS VALVES
LOOK FOR THE STANDARD MARK
TRADE JENKINS MARK

EQUIPMENT DEVELOPMENTS...

Industrial Fin Tube Perimeter Radiation

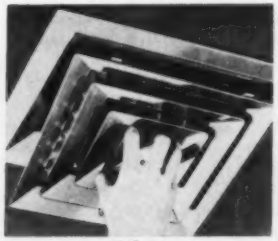
HPAC 1—"Basevector" industrial and commercial circular steel fin tube perimeter radiation — Baseline Mfg. Co., 4022 N. Washington Ave., Minneapolis 11. Sizes are 1¼ in. ID pipe size with a 3½ and 4½ in. OD fin, and 2 in. ID pipe with 4½ and 5 in. OD circular fin, in lengths up to 21 ft. The manufacturer states that higher and faster heat transfer is accomplished by the use of the spiral fin



as it is heavily crimped at the base and the expanded outer edge creates a clamping action against the pipe. The enclosures are designed with all joining strips on the inside of the cover, and are held in place by tongues and spring clips. The two piece construction (heating element and enclosure hanger) permits the heating element to expand laterally without noise, according to the company. Expanded metal enclosures also are available.

Air Diffusers with Removable Core

HPAC 2—"Agitaire" square and rectangular air diffusers in three new models, featuring built-in diffusing vanes and a new mounting frame with removable diffuser core for easier installation—Air Devices Inc., 17 E. 42nd St., New York 17. For installation, the mounting frame is fastened to the duct collar. Then the diffuser core is fitted into the frame and held there with the turning of a new mounting frame lock. When air velocity adjustment is desired, or space conditions change, the diffuser core is removed by releasing this lock. The diffusers are available in a wide range of sizes with vanes and louvers assembled in a variety of patterns to provide blows in one, two, three or four directions, with control of air volume and direction of discharge.



Diffuser

Blaster

Air Blaster

HPAC 3—Type PLDUP heavy duty, high velocity air blaster for industrial applications in foundries, pipe bending operations, etc.—Chelsea Fan & Blower Co., Inc., 639 South Ave., Plainfield, N. J. It can be moved by hand or by crane. There are a totally enclosed ball bearing motor (direct drive) and a cast aluminum, non-overloading propeller protected by mesh wire at both ends. The blower will operate with flexible canvas tubing and where static pressure is encountered. It can be used as exhauster or blower. Sizes are 18 to 42 in., 6600 to 34,000 cfm.

Magnetic Trap

HPAC 4*—Improved magnetic trap, designed for increased trapping action in process lines—Tri Clover Ma-

For your convenience in obtaining more information about any of this equipment, use this coupon. Add the new products and companies listed here to your Directory Section which you received in your January 1952 Heating, Piping & Air Conditioning, and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk, equipment and manufacturer not listed.

FOR YOUR CONVENIENCE [8-52]

Heating, Piping & Air Conditioning
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about equipment mentioned under these reference numbers in Equipment Developments and Recent Trade Literature

(Circle each HPAC number in which you are interested)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
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131	132	133	134	135	136	137	138	139	140	141	142	143	144	145
146														

Name _____ Title _____

Company _____

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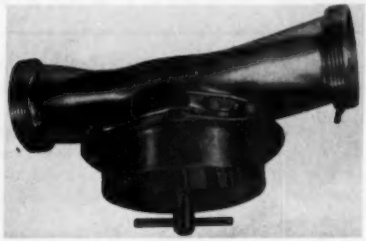
City _____ Zone _____ State _____

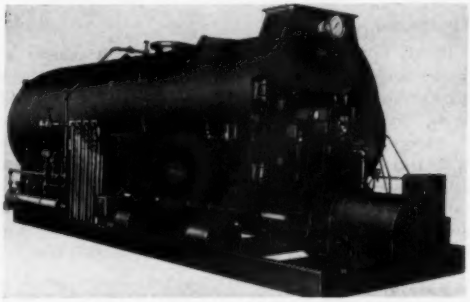
chine Co., 2809 60th St., Kenosha, Wis. It features a grid type magnet with a number of magnetic gaps. The body design is wider and flatter to bring the product closer to



the magnet at a decreased velocity, and it is intended to reduce product agitation. Fabricated of type 316 stainless steel, traps are available in 2, 3 and 4 in. OD sizes.

Steam Generators

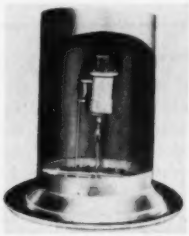
HPAC 5—Packaged steam generators designed to produce maximum heat transfer with 3 sq ft of heating surface per bhp—Cyclotherm Corp., Div. of U. S. Radiator Corp., 157 E. First St., Oswego, N. Y. The air enters the combustion chamber at a high velocity, and, mixing with the fuel, is made to spiral in a revolving vortex along the



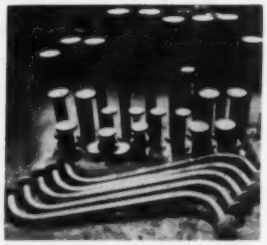
entire length of the furnace. The flame transfers heat to the fire tube by both radiation and convection. Boilers are designed for oil or gas operation from 18 through 500 hp, 15 to 200 lb operating pressure. The 500 hp boiler shown has an improved steam oil preheater for heating heavy oil, intended to assure constant flow and unvaried temperature to the burner nozzle.

Air Diffuser

HPAC 6—"Flexiflo" Type A air diffuser for automatic control of the volume of conditioned air at the outlet as a means of governing temperature and humidity—Universal Diffuser Corp., 890 Whittier St., New York 59. As dew point is reduced to satisfy humidity, air quantity must be reduced to prevent over-cooling. This diffuser, which permits considerable variation in the quantity of air delivered without materially changing the radius of diffusion, is particularly suited to this application, the manufacturer states. It is equipped with an air cylinder attached directly to the shaft controlling the movement of the blades. With this cylinder hooked up to an air cylinder operating through a humidistat, automatic control is achieved. By using a humidistat in series with a thermostat, the volume of air may be reduced when the thermostat is satisfied but the humidistat is not. When humidity becomes too high, the effective area of the diffuser will be reduced, cutting down the volume of air handled and reducing the outlet temperature of air leaving the coil.



Diffuser



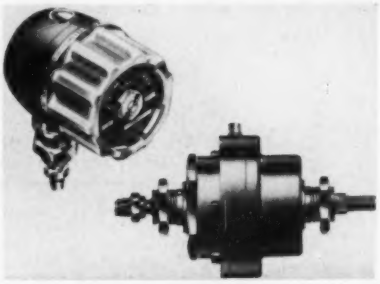
Lining

Rubber Lining for Pipe

HPAC 7**—New developments in lining and covering pipe, fittings and process equipment with rubber, for reducing maintenance costs, prolonging life, etc.,—La Favorite Rubber Mfg. Co., 264 Wagaraw Rd., Paterson, N. J. Pipe in diameter sizes from 1½ in. to any transportable size required may be lined by the new method, which does not require the breaking of a line for insertion of fittings to provide a change in flow, the manufacturer states. Through the recent development of an improved application process, according to the company, it is now possible to apply lining on three 90 deg. bends in a single length of pipe as small as 4 in. in diameter.

Positioning Control System

HPAC 8**—Hydraulic positioning control system designed for accuracy and power at remote distances — Farris Hydrotorque Corp., 563 Commercial Ave., Palisades Park, N. J. It positions valves, throttles, metering nozzles, and other devices, and will indicate level, flow, static pressure, temperature, etc. It is a single tube system independent of outside energy, and can be used in applications where conditions of corrosion, high heat and dirt are prevalent, the manufacturer states. The transmitters

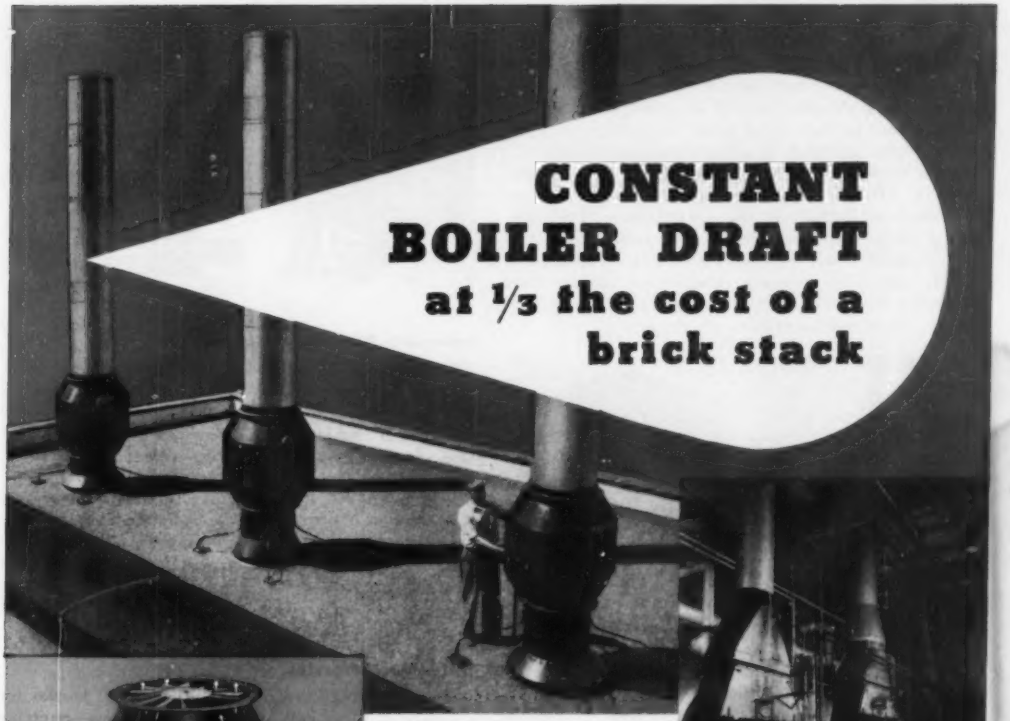


and receivers are supplied in a variety of combinations. Dials are calibrated for specific requirements. The company's remotely controlled valves for chemical and industrial services are also manufactured to meet custom requirements. They are provided in bronze, cast iron, cast steel, needle or three-way types.

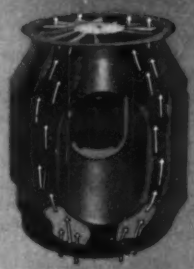
Low-Temperature Dehumidifier

HPAC 9—Low temperature package unit for humidity conditioning, designed to provide for continuous air de-

CONSTANT BOILER DRAFT
at ⅓ the cost of a brick stack



ABOVE: Mounted on the roof at Viroqua Co-op Creamery, Viroqua, Wisconsin, are two 2-stage Induced Draft Bifurcators, each with 27" fan wheel and 3 HP open drip-proof motor, and one 2-stage Induced Draft Bifurcator with 24" fan wheel and 2 HP open drip-proof motor. All have motor chamber weather louvers.



HOW BIFURCATOR FAN WORKS

The Induced Draft Bifurcator is a direct motor driven fan in a divided housing. The motor is in an isolated chamber around which the flue gases are by-passed. Thus the motor always remains cool, clean and easily accessible. Induced Draft Bifurcators are available with fan wheels from 12" through 36" in diameter, for high pressure boilers delivering up to 60,000 pounds of steam per hour and for low pressure boilers delivering up to 190,000 EDR.

If you have a difficult stack problem, read what Sylvan Dregne, manager of the Viroqua Co-op Creamery, says:

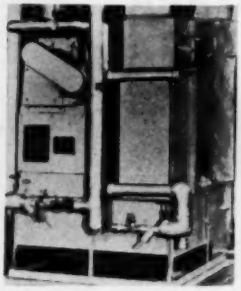
> "We have two 200 and one 125 HP oil-fired boilers. During our busy season, we use two boilers for about 15 hours a day, 7 days a week and the one boiler for about 5 hours more after the peak load is over. We installed the Bifurcator Fans in September, 1951, and we have used them since then without any service required. They have proved to be very satisfactory, and they maintain a constant draft regardless of weather conditions. We installed these fans for approximately ⅓ the cost of a suitable brick stack."

How much can YOU save by installing Induced Draft Bifurcator Fans? Ask your DeBothezat representative or write our factory for details. Write Dept. HP-852.

DeBothezat Fans

Division of American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS

livery at temperatures ranging from 32 F to −100 F — Kathabar Div., Surface Combustion Corp., 2375 Dorr St., Toledo 1. The unit is a modification of the company's conventional package unit for obtaining low absolute humidities. It is designed for use in industries where the dewpoint must be kept below the air temperature to allow for continuous operation of air conditioning equipment in the sub-freezing range (to avoid periodic shutdowns for defrosting). The new unit provides for an increased air moisture-absorbing capacity through utilization of refrigerants in its cooling coils. Such refrigerants include calcium chloride brine, methanol, ammonia, "Freon," and chilled water. Air capacities range from 1350 to 5000 cfm, and units remove 30 to 290 lb per hr of water from the air. Conventional utilities are required.



Above: Packing
Left: Dehumidifier

Plastic Packing

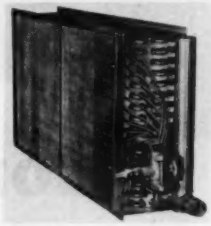
HPAC 10—Extruded "Teflon" plastic packing No. 403, designed for difficult packing applications — Packing Div., Flexrock Co., 3603-K Filbert St., Philadelphia 4. It has been used in centrifugal pumps handling acids, caustics and various solvents, operating at varying speeds from low to 3500 rpm and higher, according to the manufacturer. It is composed of shredded "Teflon," blue asbestos, combined with binders and lubricants, and extruded into an open cotton yarn jacket which confines it and aids in installation.

Automobile Air Conditioner

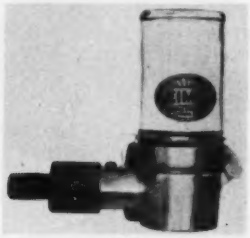
HPAC 11—Air conditioning unit for automobiles — Frigidaire Div., General Motors Corp., Dayton 1. A rotary compressor is mounted on the car engine, and a completely sealed refrigeration unit, using a non-toxic "Freon", is mounted on the shelf of the trunk. Tests have shown that heat inside a car which has been parked in the sun can be reduced to a comfortable driving temperature within a distance of six city blocks, the company states.

Air Cooling Coils

HPAC 12—Air cooling coils for use with 45 F suction, and suitable for "Freon-12" and methyl chloride — Rempe Co., 340 N. Sacramento Blvd., Chicago 12. Coils are built with $\frac{5}{8}$ in. copper tubes with seven aluminum fins per inch. Fins have $\frac{1}{8}$ in. collars and are fully expanded to coil tubes, the manufacturer states. Coils are tested under 350 lb pressure, dehydrated and sealed. They are furnished with multi-outlet expansion valves made-on and have been sized for 80 deg inlet, and 63 deg outlet air at about 400 cfm per ton and 500 fpm velocity. Air friction through the coils is 0.20 in. water at 500 fpm. Standard sizes range from 2 to 15 ton coil capacity. Four or six row coil assemblies are available.



Coils



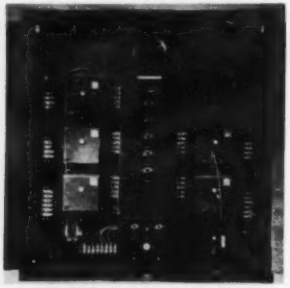
Oiler

Automatic Oiler for Air Pumps

HPAC 13**—Model E-113 oiler developed to automatically feed measured amounts of oil to the company's oil pumps—Leiman Bros., Inc., 146 Christie St., Newark 5, N. J. It provides adequate lubrication of wings and vanes, yet delivered air is virtually oil-free for operations requiring low oil vapor content, the manufacturer states. Any oil from SAE 10 to SAE 70 may be fed, and rate of feed is adjusted from one drop in four minutes to four drops in one minute. The transparent reservoir holds 3 oz. The oiler feeds only when the pump is running, and is actuated by a draft of air passing through it, so that it may be used on a vacuum pump, or an inlet of a pressure pump.

Large Spray Nozzles

HPAC 14—New group of "FullJet" spray nozzles for a variety of heavy duty industrial applications—Spraying Systems Co., 3219 Randolph St., Bellwood, Ill. The largest has an orifice diameter of 5 5/16 in., is 21 in. high, and provides passage for "impurities" without clogging as large as $2\frac{5}{8}$ in. in diameter, according to the manufacturer. Capacity of this size is 1550 gpm at 10 psi. Nozzles of this type are supplied with flange mounting or with female pipe connection, in a range of over 30 sizes. All are larger than the standard nozzles offered by the company.

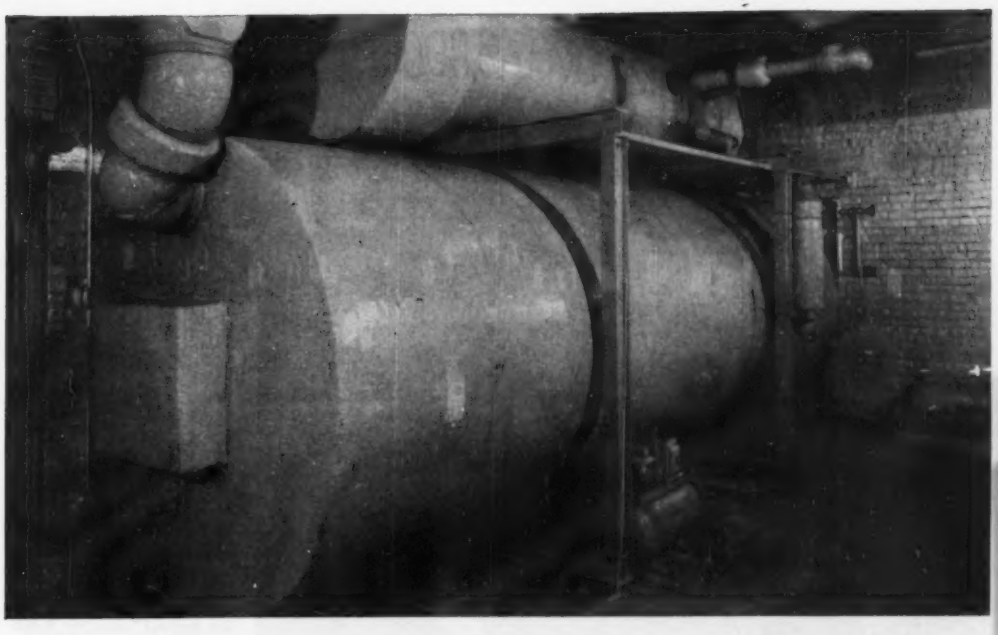


Above: Nozzle
Right: Control

Centralized Combustion Safety Control

HPAC 15—"Protect-O-Glo" multiple burner combustion safeguard system for two to 16 burners — Industrial Div., Minneapolis-Honeywell Regulator Co., Wayne & Roberts Aves., Philadelphia 44. Using the flame rectification principle, the system features individual flame detecting relays for each burner housed in a single cabinet. These relays

(*Continued on Page* 188)



How old is the insulation on this brine cooler?

You'd never guess the age of this insulation job by looking at it. The insulation on the brine cooler and piping shows almost no signs of deterioration. The cork lagging and covering are still tight against the units and there's no evidence of buckling or frost build-up. Yet this job was installed in 1930—22 years ago!

This installation is located at Henrici's Merchandise Mart Restaurant in Chicago, Illinois. After all these years of continuous service, the equipment is still highly efficient, holding temperatures of 17° below zero with remarkably low refrigerating cost.

It takes fine-quality materials and expert application to give that kind of service. But with Armstrong's Corkboard and Cork Covering, records like this one aren't unusual. Many cork installations are still performing at peak efficiency after 20, 30, and even 40 years!

In addition to furnishing you with a complete line of low-temperature insulating materials, Armstrong's contracting organization can take over the entire job for you. We'll specify the right materials for your particular job and install them according to approved methods of application. You get an insulation job that insures long, low-cost service. For further information, just contact your nearest Armstrong office or write Armstrong Cork Co., 4408 Concord St., Lancaster, Penna.

Complete Insulation Contract Service

There are many factors that can't be written into an insulation contract, but which can largely determine whether or not the agreement will be entirely satisfactory. They include:

1. Financial responsibility—resources to complete the contract despite any unforeseen events.
2. Integrity—a reputation for quality work and for prompt settlement of any justified complaints.
3. Technical ability — experience, plus technical and research staff to do the job in accordance with best practices.
4. Manpower resources — trained supervisors and workmen able to handle any contract efficiently.
5. Efficiency — ability to deal with problems of accounting, tax provisions, insurance, and workmen's compensation.

You get all these with an Armstrong Contract

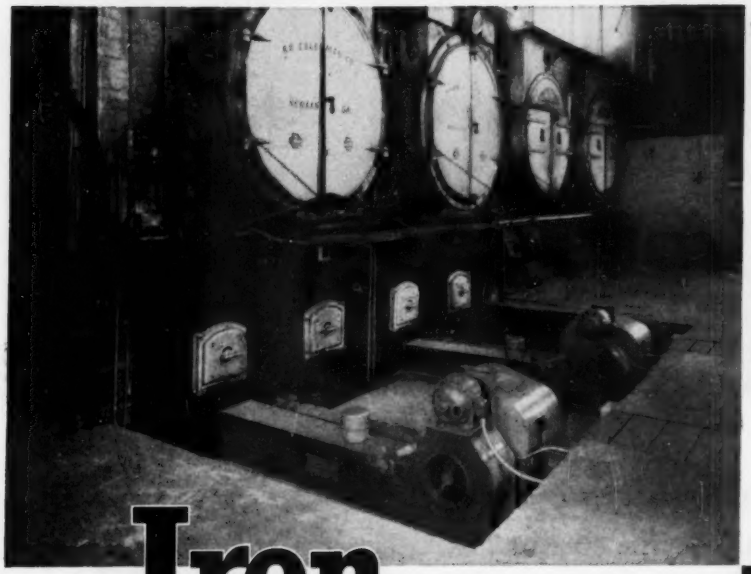
ARMSTRONG'S INDUSTRIAL INSULATIONS

For temperatures from 300° below zero to 2800° F.

"Iron Fireman saves over $5,800 a year at Reeves Brothers' Chesnee (S.C.) Mill"

says William C. Ariail, Jr.
Supt. of the Plant

"Firing automatically adjusted to the load gives us peak steam production when needed and eliminates excess firing during low demand," says Mr. Ariail. "Fuel costs dropped from $13,416 to $10,400 a year. Total savings, including labor are $5,805."



Two Iron Fireman underfeed Coal-Flow stokers in Reeves Brothers textile mill, Chesnee, S. C. Coal is fed directly from main bunkers without manual handling. Steam is used for both heating and processing.

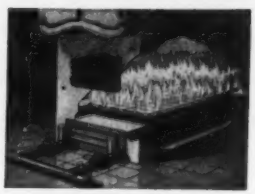
Iron Fireman

The stoker with the modulated fire and built-in coal conveyor

Coal flows automatically from the bunker to the fire, without the cost of manual handling or use of expensive auxilary conveyors. Equally important, its flow is scientifically regulated to provide the exact amount of heat required to maintain the boiler pressures or temperature you require. At the same time the rate of air supply is constantly adjusted to the coal feeding rate.

Important savings are the result of combining this efficient firing with automatic fuel handling. You cannot afford to decide on new firing equipment without considering Iron Fireman.

Iron Fireman Rotary Oil Burner
Fires low-cost, heat-rich heavy oils (No. 5 and No. 6) with complete dependability, regardless of viscosity changes. A real money saver. Capacities up to 500 boiler horsepower.



Iron Fireman
Commercial Gas Burner
Vertical type is illustrated above. Others include Radiant Inshot and Ring types. Flexible operation, easy to install. Capacities to 500 boiler horsepower.

MAIL COUPON FOR FULL INFORMATION

IRON FIREMAN MANUFACTURING CO., 3274 W. 106th St., Cleveland 11, Ohio.

Please send literature as checked:

- ☐ Coal-Flow Stoker
- ☐ Rotary Oil Burner
- ☐ Commercial Gas Burner

Name_____

Address_____

City_____

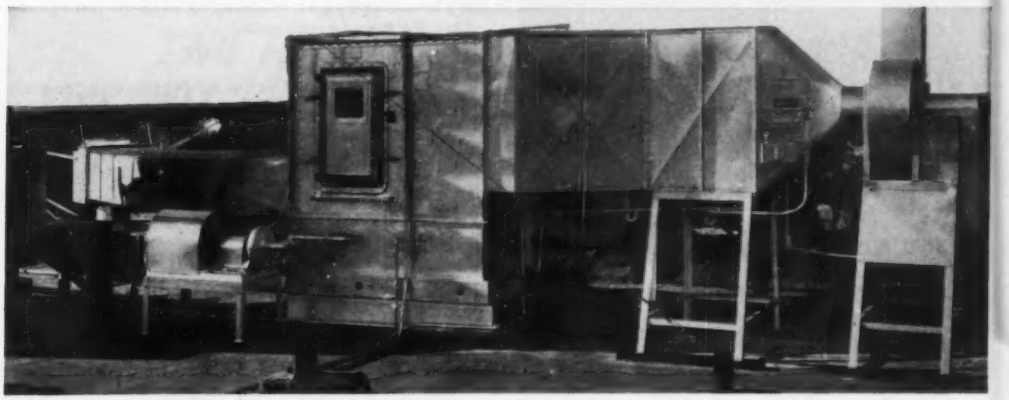
State_____

FIELD REPORT

...actual quotations reporting on Electromaze installation at National Schools, Los Angeles, Cal.

CUSTOMER'S REPORT: *"Electromaze has given satisfactory service for over two years, has approval of Los Angeles Air Pollution Control Board", says G. A. Applegate, Chief Instructor, National Schools.*

CONTRACTOR'S REPORT: *"Electromaze solved a tough air pollution problem, proved to be an entirely satisfactory installation", says V. W. Sharpe, Sharpe Engineering Co.*



EXHAUST SMOKE from diesel engines used by students of National Schools, Los Angeles, Cal., was causing neighbors to complain about the damage being done to their buildings and cars—was adding to the city's smog problem.

Cooperating with the Air Pollution Control Board, the school studied the problem and decided that an Electromaze electrostatic dirt precipitator would be the most practical and economical solution.

After two years of service, both the customer and contractor report that the Electromaze proved to be highly efficient and dependable in removing the major portion of the carbon and oil particles from the smoke.

Electromaze is made up of individual cells that slide in and out like filing cabinet drawers. The steel frames come in pre-fabricated sections. You can save up to 50% on installation time because all you do is bolt the sections together. Cleaning Electromaze is quick and easy—right in place, or by removing the cells. For more information, ask your consulting engineer about Electromaze or contact your nearby Air-Maze representative. Air-Maze Corp., Cleveland 5, Ohio.

AIR FILTERS
SILENCERS
SPARK ARRESTERS

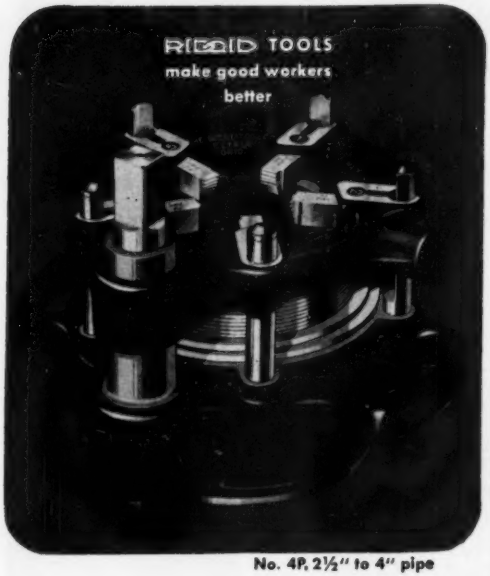
AIR-MAZE
THE FILTER ENGINEERS

LIQUID FILTERS
OIL SEPARATORS
GREASE FILTERS

Why Good Pipe Fitters Choose

RIDGID

4P Geared Pipe Threader



No. 4P, 2½" to 4" pipe

Extra easy to carry and put on pipe

★ Balanced loop handles—easy to swing 4P where you want it.

★ Mistake-proof workholder sets to size *before* put on pipe—only one set screw.

★ Practically no upkeep—drive pinion in oilless bronze bearing; safe enclosed gear.

★ 4 sets of 5 high-speed steel dies for 2½", 3", 3½", 4" pipe. Ratchet handle; RIDGID Universal Drive Shaft available. Also special 4P for conduit.

★ Buy efficient 4P at your Supply House.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO

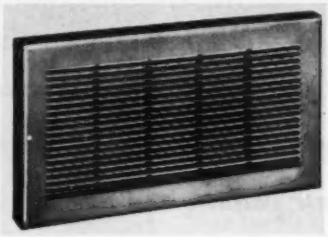
RIDGID
Work-Saver Pipe Tools

(*Continued from Page* 184)

are used with a photocell flame detector in the case of oil-fired burners, or with a flame electrode detector on gas or gas-piloted oil-fired installations. The flame detector and relay circuit act to shut down the fuel supply in the event of flame failure at the burner. The cabinet also houses push-buttons, signal lights, etc. There are three operating options available: sequence, unison, or independent light-off.

Grilles

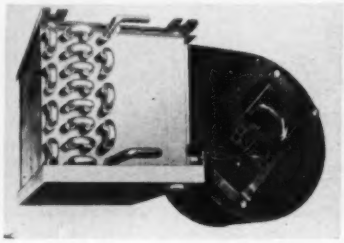
HPAC 16—Series 20 baseboard return air faces and Series 10FG flat sidewall grilles now offered with horizontal louvers deflected downward 23 deg to avoid see-through



to stackheads or building construction behind grilles — The Lima Register Co., 651 N. Baxter St., Lima, Ohio. The change does not affect the free flow of air through the grilles, the manufacturer states.

Room Air Conditioners

HPAC 17—"Spotaire" Series HRC individual room air conditioners, in concealed types or cabinet enclosed models with 3, 4 or 6 row coils, designed for applications where silent operation is essential — Drayer & Hanson, Inc., 3301



Medford Ave., Los Angeles 33. Quiet operation is effected by a large fan revolving at low speed. Units which may be used in hospitals, hotels, offices, etc., heat, cool, filter, ventilate and recirculate air. They are available for hot or cold water or direct expansion refrigerant, and require no duct work.

Open Channel Flow Meters

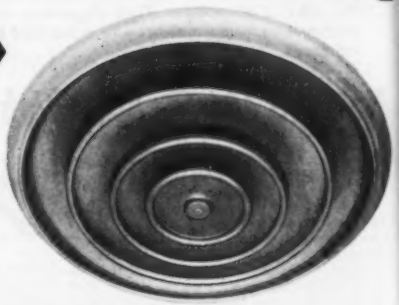
HPAC 18—Series 500 open channel flow meters for measuring, recording, and controlling the flow of water, sewage, industrial plant effluent, irrigation water, and other liquids—The Bristol Co., P. O. Box 1790, Waterbury 20, Conn. The flow is determined by measuring the head of liquid flowing through a flume or over a weir in the flow channel. This measurement of head is interpreted by means of a cam, cut to the equation of the weir or flume, into terms of flow, which is then recorded on a

NEW MODERN EFFICIENT

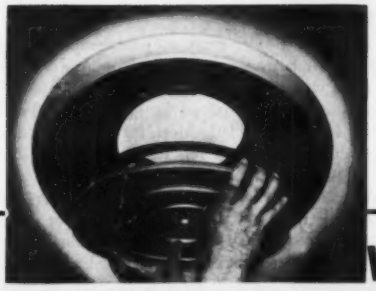
CARNES

CIRCULAR CEILING DIFFUSERS

MODEL BR



COMPARE ONLY THESE TWO FEATURES AND YOU WILL PICK A CARNES



1 SIMPLE TO ADJUST:

No tools required — Finger tip control makes it easy to adjust for any desired air pattern. Simply revolve the small center plate clockwise to raise all the cones, which increases the downward deflection, and counter-clockwise to lower all the cones deflecting the air for horizontal patterns. Any desired pattern between horizontal and vertical can be easily and quickly obtained.

2 EASY TO INSTALL:

The adjustable cone assembly is made as a complete unit and to install requires only to engage to ceiling plate, and turn a few degrees clockwise. A spring loaded pin on the ceiling plate slips into a matching hole in the inner assembly, and locks it into position. This operation is done quickly and without tools, thus eliminating danger of marring or scratching finished surfaces.

W. R. CARNES CO., Verona, Wis.

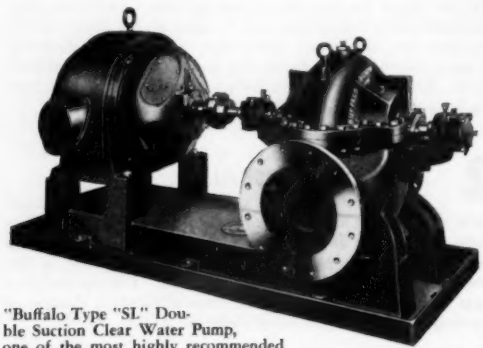
"Buffalo" Tips on Better Pumping

PROPER INSTALLATION
—A "Must" For Best Results

1. *Locate pump as close as possible to water supply* to keep suction line short and direct. Give your pump the best chance for peak performance.
2. *Keep friction losses at a minimum* by keeping fittings to a minimum and suction pipe larger than the suction opening of the pump.
3. *Avoid air locking in suction line.* Be sure suction line has no "humps" or "hollows" where air pockets might form.
4. *Maintain shaft alignment.* Pump foundation should be sturdy enough to avoid sagging, which causes misalignment. When installing pump, check alignment with feeler gauge between impeller and clearance ring to be sure clearance is the same at all points. Poor alignment results in excessive coupling and bearing wear, and lowered efficiency.

Be Sure The Pump Is Right, Too
— Specify "Buffalo"

Since the installation can be no better than the pump, it is important to pick one of known quality. "Buffalo" Pumps are giving satisfaction in every industry, handling every type of liquid from clear water to paper stocks. They are known for their high efficiency, their simple maintenance, their long life on the job. Specify "Buffalo" and be sure of the results you want. Below is one of many types of dependable "Buffalo" Pumps.



"Buffalo Type "SL" Double Suction Clear Water Pump, one of the most highly recommended pumps for humidifier and air washer service. WRITE FOR BULLETIN 955-P.

"Buffalo"
BUFFALO PUMPS, INC.
171 MORTIMER STREET BUFFALO, N. Y.
Subsidiary of Buffalo Forge Company
Canada Pumps, Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities
A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

uniform chart and integrated if desired. Mechanical and electrical types are available.

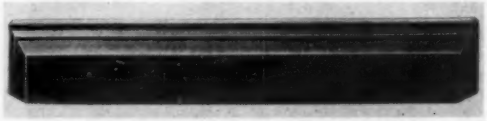
Above: Valve
Left: Meter

Air Valve for Hot Water Systems

HPAC 19—"Duovent" air valve for hot water systems, which shifts from manual to automatic venting with fingertip regulation — Keeney Mfg. Co., Main St., Newington, Conn. The unit is two valves in one. In manual venting, air escapes directly through a vent at the base. In automatic venting, a hollow pin blocks this route and air escapes up through the pin and out through ports in the upper part of the valve. Hygroscopic discs, which swell when contacted by water, close the ports after air has been vented. Unscrewing the top of the valve an eighth of a turn opens the manual vent. A similar turn in the opposite direction reseats the pin, producing automatic operation.

Perimeter Air Diffuser for Heating and Cooling

HPAC 20**—Perimeter diffuser which is installed with back of grille flush with wall, and cut work coming through the floor rather than the wall — Titus, Inc., Waterloo, Ia. The installation method affords savings in time, labor, and



expense, the manufacturer states. Ducts are shorter, and fewer turns in the duct work are required. The diffuser is slipped over the boot. Baffles on the inside of the unit throw air streams in a 180 deg arc, blanketing the outside wall with warm or cold air, depending on the installation.

Pipe-Cutting Pantograph

HPAC 21**—Pipe-cutting pantograph, a semi-automatic guided torch machine designed to produce prepared and beveled cuts, either straight, curved, or angular, for almost any intersection required in pipe fabrication — Vernon Tool Co., Ltd., 1101 Meridian Ave., Alhambra, Calif. After the machine is set, cuts are burned automatically. No layout or templates are required; the operator selects and installs the proper cam. Since cuts are smoothly finished, there is no need for grinding or cleaning. The machine requires no special foundation and is portable. If powder type torches are used, alloy steel pipe can be satisfactorily burned, according to the manufacturer.

Air-Operated Butterfly Valve

HPAC 22—Pneumatically operated butterfly valve for control of air, water or steam flow—Industrial Div.,

This 7-Letter Word Tells the Story

• There are many descriptive words and phrases we might use to prove the effectiveness of Zallea Stainless Steel Expansion Joints as the ideal medium to absorb thermal expansion and contraction in pipelines. But no single word has more convincing meaning . . . more significance than the simple 7-letter word . . . "*reorder.*"

Over the past 23 years, thousands of industrial organizations have expressed their confidence in our products by reordering not once, *but time and time again!*

Here's a sample of the record:

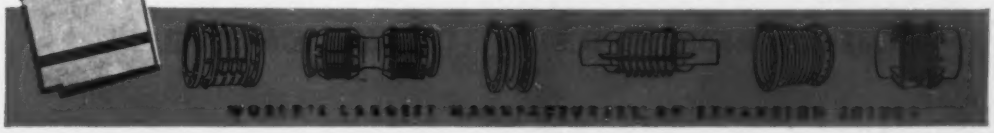
Company	Number of Orders Placed*	Since
American Viscose Corp.	79	1940
Bethlehem Steel Corp.	81	1935
Carbide & Carbon Chemical Co.	93	1936
Consolidated Edison Co.	115	1935
Dravo Corporation	53	1939
E. I. du Pont de Nemours & Co., (Inc.)	300	1934
Ebasco Services	46	1934
Hercules Powder Co.	133	1937
Koppers Co., Inc.	165	1942
Nordberg Mfg. Co.	174	1942
Sun Oil Co.	60	1938
Texas Co.	261	1938

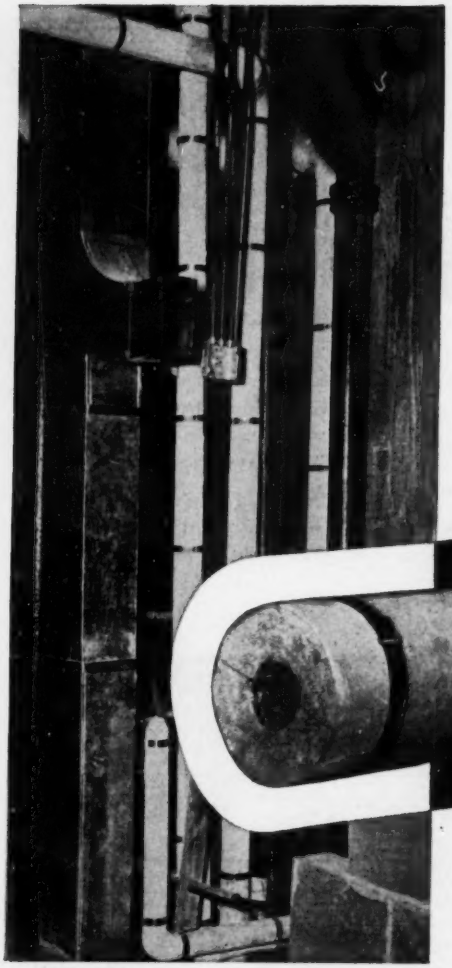
**Including as many as 485 expansion joints in a single order!*

This acceptance is your assurance of the dependable, economical performance you'll receive when you, too, order and *reorder* Zallea Stainless Steel Expansion Joints. Why not write us *today?* Zallea Brothers, 816 Locust Street, Wilmington 99, Del.

Catalog 47 and Bulletin 351 describe the complete line of Zallea Expansion Joints and Flexible Connectors. Write for copies today.

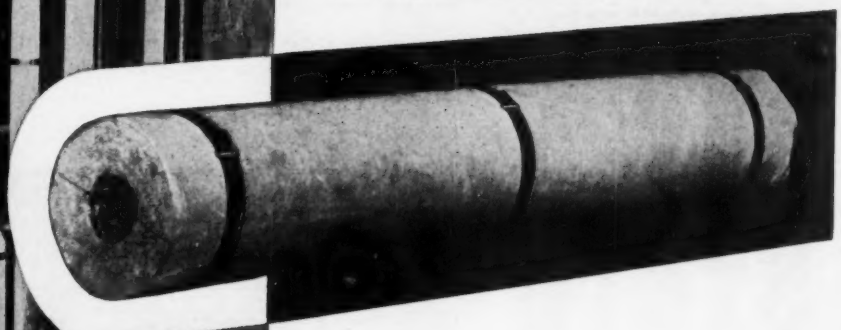
Zallea
EXPANSION JOINTS





YOU SAVE FROM THE VERY BEGINNING WITH

Amocel



...the easy-to-use, long lasting pipe insulation

Probably no one will ever again need to see this installation of long-lasting Amocel, for "out of sight means out of mind" with this durable insulation. There's no concern about replacement, because Amocel lasts the life of the building, so steam and hot water lines need not be accessible for insulation maintenance. Amocel is Unarco's economical pipe insulation for all commercial uses up to 600°F. temperature. For higher temperatures—up to 1200°—specify Unarco Unibestos. Phone your nearby Unarco Distributor for information and from-stock deliveries. *Write for Bulletin 76-109.*

UNARCO

UNION ASBESTOS & RUBBER COMPANY

DEPT. A-8 332 SOUTH MICHIGAN AVENUE • CHICAGO 4, ILLINOIS

UNARCO

Distributor of the Month

Eastern Steam Specialty Co.

119 BARCLAY STREET

NEW YORK 7, NEW YORK

In New York City and immediate vicinity, it's Eastern Steam Specialty Co. for dependable Unarco insulations. Since 1920, Eastern has served the industrial needs of this active, diversified area.

Qualified insulation specialists are quickly available for helpful suggestions, and immediate delivery is always assured from two Manhattan warehouse stocks, soon be be augmented by similar facilities in New Jersey.

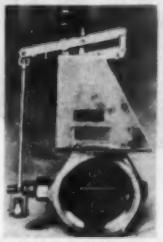
For competent engineering assistance —for quality Unarco products—it's Eastern in New York City. Phone Worth 4-8550 for sound advice and good insulations.

INDUSTRIAL Insulations

PRODUCTS OF

UNION ASBESTOS & RUBBER COMPANY

Minneapolis-Honeywell Regulator Co., Wayne & Windrim Aves., Philadelphia 44. The valve motor operates on a controlled air pressure range of 0 to 15 psi, and adjustable mechanical stops enable the wing rotation to be limited for special applications. The valve is sized from 1½ to 6 in., with screwed connections. Body, wing and trim material is bronze. Maximum operating temperature is 250 F, maximum pressure, 20 psi.



Above: Diaphragm

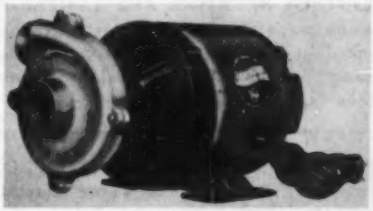
Left: Valve

Arc Welded Diaphragms

HPAC 23—Arc welded diaphragms of extremely thin stainless steel, "Ni-Span C," and phosphorus bronze—The Bristol Co., P. O. Box 1790, Waterbury 20, Conn. Diaphragms in thicknesses of from 0.0015 to 0.005 in. for pressure transducers, pressure elements and seals for many applications, are being arc welded by the company.

Pump

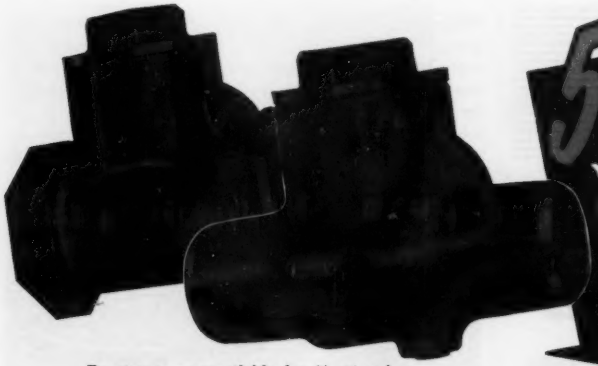
HPAC 24**—"Laundro-Pak" small, automatic pump for use wherever liquids accumulate below sewer level, which can be automatically started and stopped if required — Lancaster Pump and Mfg. Co., Manheim Park,



Lancaster, Pa. This bronze-fitted pump is equipped with a ¼ hp, 110 volt motor. Applications include hot water circulation on industrial type radiant heat installations, circulation for air conditioning and refrigeration, etc.

Indicators for Liquid Level and Valve Position

HPAC 25—Miniature indicators for liquid level and valve position, designed to occupy a minimum of panel board space, and developed for the company's line of graphic panel instruments — Industrial Div., Minneapolis-Honeywell Regulator Co., Wayne & Windrim Aves., Philadelphia 44. The two units are similar in appearance, the differences being in the color of the indicating tapes and the availability of alarm switches on the level indicator. The colored metal tape moves vertically behind the indicating scale, giving the illusion of a liquid level sight glass. Reverse of direct action is obtained by a linkage attached to a standard 3 to 15 psi pneumatic receiver, which provides sufficient force to eliminate tapping error, the manufacturer states.



5 REASONS WHY..

YOU SHOULD SPECIFY EQUA-TEMP BALANCING VALVES For Hot Water Radiant Heating Systems

Equatemps are available for ¾, ½ and ¾-inch tubing or for ¾, 1, 1¼ and 1½ inch threaded pipe.

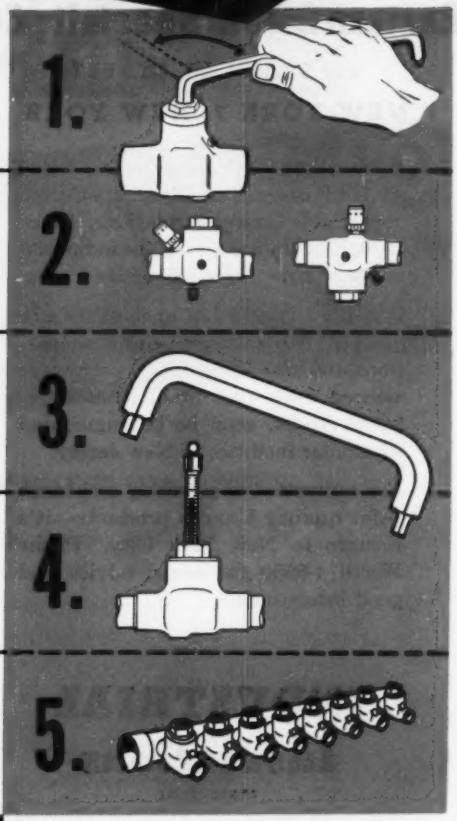
EQUATEMPS ARE EASY TO REGULATE—Full open to closed in quarter turn of stem. Equatemps are absolutely leaktight, allowing complete shut-off of individual lines.

DRAINING AND VENTING POSSIBLE—Equatemps are fitted with two drain plugs, one in top and one in bottom. Venting or draining is possible in either upright or inverted position.

CONTROL SETTINGS ARE TAMPER-PROOF—Tampering is discouraged by settings which can be locked once the system is properly balanced. To change settings requires special key or two different Allen-type wrenches.

INTEGRAL THERMOMETER WELL PROVIDED—Equalizing temperature of water in return lines is quick and effective method to balance system. The thermometer well drilled in valve stem is a handy place to take accurate temperature readings.

COMPACT AS WELL AS VERSATILE—Eight Equatemp solder-type valves can be manifolded in space 18-inches wide. Manifold units are available with 3 or 4 outlets—can be slipped together to form headers of any desired length.



For additional information on Equatemp Valves and Manifold units, send in this coupon requesting Equatemp folder 1214V.

Name _____

Company _____

Street _____

City _____ State _____

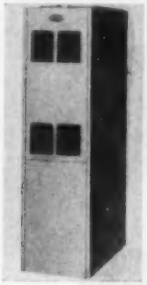
4210-V

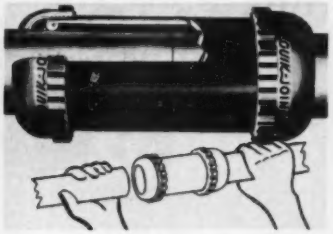
Ohio Brass

MANSFIELD • OHIO

Forced Air Furnace

HPAC 26—Models 70FA and 100FA gas fired, vented forced air furnaces (AGA input rating of 70,000 and 100,000 Btu) — Utility Appliance Corp., 4851 S. Alameda St., Los Angeles. They use glass fiber air filters, and are adaptable to zoned warm air heating in larger buildings. Units are self-contained, completely automatic, and are available for use with natural, manufactured or liquefied petroleum gases. They are equipped with the new "Dy-Rekt" drive blowers.





Above: Connector

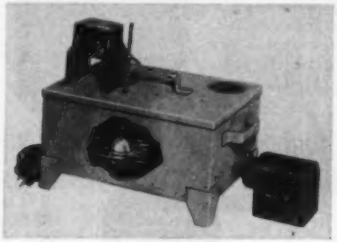
Left: Furnace

Threadless Pipe Connector

HPAC 27**—Factory assembled pipe coupling, requiring no thread cutting, which is designed for installation in any piping system in less than a minute — Quik-Joint Mfg. Co., 469 E. 159th St., Harvey, Ill. Pipes to be connected are inserted into the ends of the coupling body and the lock nuts are wrenched to desired tightness. The joint is flexible, tightly sealed, and able to withstand working pressures up to 2000 psi, the manufacturer states. No castings are used; the body is of pipe steel with a greater wall thickness than that of the pipe to be joined. The compression rubber gasket is provided in various formulas, depending on the application. Applications include gas, water, air and oil lines. It is available in sizes from ½ to 1½ in. IPS as straight coupling, 90 deg and 45 deg ells, and welded and threaded adapters.

Condensate Pump

HPAC 28**—Automatic condensate pump with tank capacity of 5 gal, and 5/8 in. OD tubing outlet to which is coupled an all rubber bantam size centrifugal pump of 1/35 hp — Samuel S. Gelber Co., 162 N. Clinton St., Chicago 6. The pump has a synthetic rubber impeller molded to a stainless steel shaft. It has a flooded suction, never requires priming, and wide clearance in the housing as well as other features which permit solids to pass through without stalling the motor, the company states. It will move 450 gph at 2 ft to 168 gph at 8 ft. Since it



FUMES FOUL AIR SMOKE

INDUSTRIAL AIR CAN SOLVE YOUR PROBLEMS

BELT DRIVEN DUCT FAN

For spray booths, volatile or explosive fumes, excessive temperatures, dust or any operation requiring the motor to be out of the air stream.

JOB fitted DUCT FANS in sizes from 14" to 72" in diameter and from 1000 to 100,000 C.F.M. Also to your specifications and job needs.

Belt Driven Duct Fan. Powered by Recognized Accepted Make Motors. High Tensile Strength Cast Aluminum Blades.

DUO DUCT Showing Air Flow

The Industrial Air Duo Duct is specially designed to exhaust corrosive gases, fumes, smoke, and to induce draft on boilers. It has two exhaust ducts joined at both the suction and discharge ends. Both motor and bearings are mounted in the internal well, protected from the harmful corrosive effects of exhaust air, smoke or fumes. The internal well is open on two sides for proper and efficient cooling. The entire unit is designed for temperatures as high as 700° Fahrenheit and is available in diameters from 14" through 72", 1000 to 100,000 C.F.M.

Tubeaxial
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Utility Man Cooler
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Duct Fans
Roof Ventilators
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INDUSTRIAL AIR

Represented in All Principal Cities
Write Dept. B11 for Catalog of Complete Line

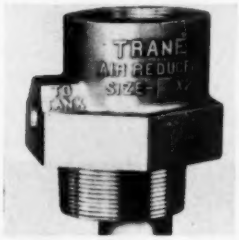
THE HARVEY P. BERTRAM CO.

1008 W. Ninth St. Cincinnati, Ohio

is low, it need not be placed in a pit. The automatic pump control consists of a micro-switch actuated by a copper float inside the tank. The single phase motor operates on 115 volts (6 ft cord and plug), 3000 rpm. Either 3/8 in. standard water pipe, 5/8 in. OD rubber tubing or standard 5/8 in. garden hose can be used in the discharge outlet.

Fitting for Removing Air at Boiler

HPAC 29*—"Air-Reducers," a fitting for removing air at the boiler — The Trane Co., La Crosse, Wis. The design eliminates two adapter connections, effecting easier, faster, and more economical boiler installation, according to the manufacturer. The device is a pipe within a pipe. The brass inner tube extends the hot water system's supply main below the surface of the water in the boiler, preventing air from entering piping and heating units. Air collecting at the top of the boiler is bled off to a compression tank through the outer casting. The boiler reducing bushing is incorporated into the fitting, and a nipple is eliminated by fitting the device directly to the boiler. It is offered for boiler and main sizes ranging from 1 x 1½ in. to 3 x 4 in., in standard increments.



Fitting

Seal

Elastic Piston Seal

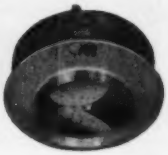
HPAC 30**—One-piece molded elastic piston seal, designed as an alternate for diaphragm or piston operated devices — Farris HydroSeal Corp., 563 Commercial Ave., Palisades Park, N. J. A movable, leakproof seal for all pressures and strokes, it can be incorporated in the design of pneumatic and hydraulic motors, shaft seals, valve seals, pumps, etc., the company states. It is offered in natural rubber, and synthetics for special applications. It utilizes a peripheral bead for pressure tightness, and since it is a cylindrical form of rubber, will stretch rather than flex, within the limits of the materials being used.

Fiber Glass Pipe Insulation

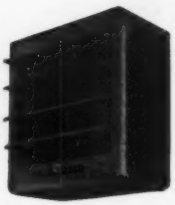
HPAC 31—"Fibreglas" preformed pipe insulation with increased density — Owens-Corning Fiberglas Corp., 1911 Nicholas Bldg., Toledo 1. The new insulation is described by the manufacturer as being firmer and more rugged than the previous product of lesser density, with greater ability to withstand the kind of handling encountered in normal applications. The new insulation retains its lightweight qualities, does not cause corrosion, is unaffected by moisture, is odorless, and has high thermal efficiency, according to the company. It is furnished in hemi-cylinders 3 ft long, for pipe sizes ranging from ⅜ in. copper tubing through 12 in. iron pipe. Segments 3 ft long are furnished for iron pipe ranging in size from 12 through 33 in. Three types of jackets are offered: a muslin cloth, a vapor-

A unit heater for every need from HERMAN NELSON

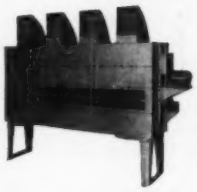
Vertical shaft propeller-fan type unit heater—*especially suited to buildings with high ceilings—up to 50 feet.*



Horizontal shaft propeller-fan type unit heater—*the most generally useful of all space heaters.*



Centrifugal-fan type unit heater—*for efficient heating and ventilating of large industrial spaces.*



De Luxe unit heater—*an attractive, quiet operating unit designed for stores, offices, churches, etc.*

Write for detailed information about any type Herman Nelson Unit Heater to: Dept. HP-8

AAF herman nelson moline illinois

HERMAN NELSON

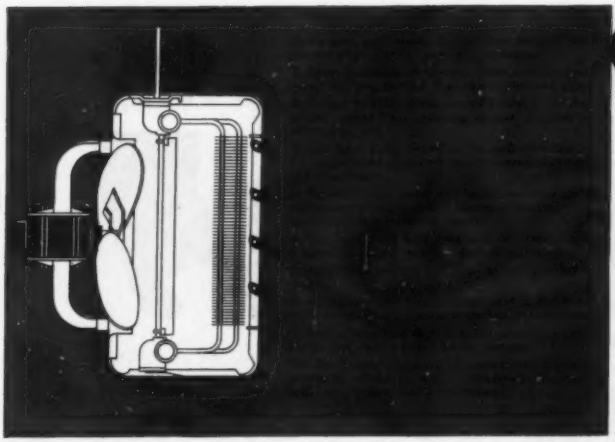
Division of AMERICAN AIR FILTER COMPANY, INC.
MOLINE, ILLINOIS

...FROM

HERMAN NELSON

Here is the economical, efficient solution to the heating problems of most commercial and industrial establishments. There are 18 sizes of Herman Nelson horizontal unit heaters. B.T.U. output ranges from 25,000 to 350,000 per hour. All units operate on steam or hot water. Single or two speed motors are available in either 115 or 230 volts, AC or DC.

Herman Nelson unit heaters are ahead of the field because constant engineering development and research plus functional design have earned this position—the result of 45 years of experience in the production of heating and ventilating equipment.



SUPERIOR IN *BOTH* HEATING ELEMENT AND FAN DESIGN

Herman Nelson unit heaters are suitable for the smallest service station or the largest factory. Each size unit does an extremely efficient job of heat transfer and distribution. This is because *both* heating element and fan are unique in design. Study the 10 points listed on the left and you'll see that every part has been carefully engineered to do its particular job best. The result is a highly functional and efficient unit housed in attractive, sturdy, steel cabinet, easy to install — gives years of trouble-free dependable service.

AAF herman nelson moline illinois

HERMAN NELSON

Division of **AMERICAN AIR FILTER COMPANY, INC.**

MOLINE, ILLINOIS

Controlled Pressure

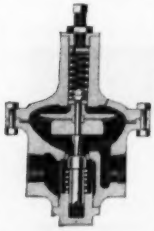
for efficient operation

Clark Pressure Reducing and Regulating Valves

are precision-made for positive pressure control on air, gas or steam lines.

Where different types of equipment, with varying pressure requirements, are operated from a common line, Clark Regulating Valves can be depended on to deliver automatically the "just right" pressure to each.

Save on fuel, maintenance and protect expensive equipment. Ask your Clark representative to specify the right Clark valves for your needs . . . or write us direct.

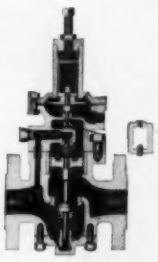


TYPE KRV

Pressure Reducing Valve. Diaphragm Operated-Single Seated Valve. Sizes ½" to 1½" for initial pressures up to 250 P.S.I. Reduced pressures to 85 P.S.I.

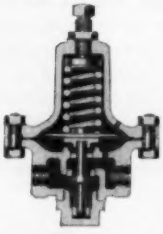
TYPE CRV

Pressure Reducing Valve. Integral pilot controlled, piston operated. For pressure control from "dead end" to full capacity. Sizes ½" to 6".



QUICK-CLEANING STRAINERS

Remove dirt, scale and grit from steam, fluid and gas lines. Sizes ½" to 3" I.P.S. For pressures to 250 P.S.I.



TYPE ORV

Pressure Reducing Valve. ¾" and ½" Single Seated, Spring Loaded, Diaphragm Actuated. For initial pressures to 250 P.S.I. Reduced pressures to 200 P.S.I.

THE **Clark** MANUFACTURING COMPANY

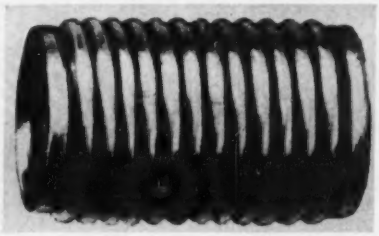
THE HOME OF DUO STEP LEVERAGE

1830 E. 38th St. • CLEVELAND 14, OHIO

resistant, foil laminated type for dual temperature and refrigerated lines, and a heavy waterproof roofing felt for outdoor use.

High Pressure Bellows

HPAC 32—Bellows with pressure ratings in excess of 3000 psi — Clifford Mfg. Co., 152 Grove St., Waltham 54,



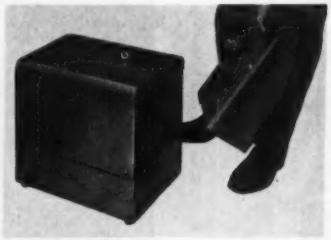
Mass. Material is stainless steel. Outside diameter of the model shown is 9/16 in. and pressure rating is 3600 psi.

Multi-Stage Centrifugal Pumps

HPAC 33—Redesigned line of Class CNTA horizontal, multi-stage centrifugal pumps for medium pressure applications — Ingersoll-Rand Co., 11 Broadway, New York 4. The pumps are intended for boiler feed, mine dewatering, marine, refinery and general industrial services to 800 lb. Built in 1½ and 3 in. sizes, units are available with 4, 6 or 8 stages. The horizontally split, smooth bore cylindrical casing contains a unit type rotor assembly composed of the shaft, impellers, and channel rings, which contain the multiple-volute fluid passages. The same interstage sealing method used in the company's higher pressure class of pumps is used in this line.

Electric Dehumidifier

HPAC 34—"Oasis" electric dehumidifier with "Fibreglas" moisture drawer — Ebco Mfg. Co., 401 W. Town St., Columbus 8. The drawer is lightweight, spillproof



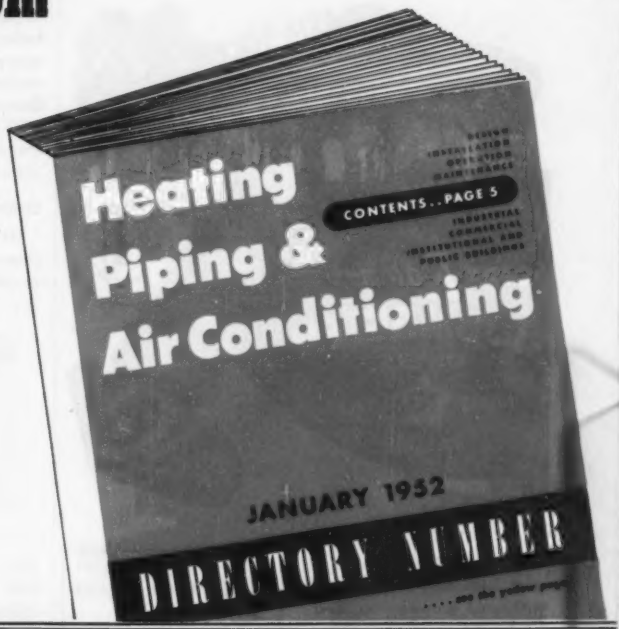
and shatterproof, and is simple to remove and empty, the manufacturer states. The dehumidifier is designed to service up to 10,000 cu ft and to remove up to 3 gal of water daily. It plugs into a 60 cycle outlet.

Joint Seal Compound

HPAC 35—Compound 411, a metallic joint seal designed to assure easy removal of cleanout plugs and to serve as an anti-seize coating—Armite Laboratories, 6609 Broad St., Los Angeles 1. Intended for general use, it consists of not less than 63 percent pure metallic lead, plus

Replies Came from All Parts of the Country

. . . . over 90% stated that they find the January Directory Edition extremely useful as a reliable source of product information.



- ***Not long ago we picked every twentieth subscriber and, by means of a questionnaire, we asked this engineer or contractor what he thought of HP&AC's Directory Number.***
- ***Most of those replying—in fact over 90%—answered that they refer frequently to their 1952 Directory Editions when writing specifications or in need of a product.***
- ***We try hard to make each January Directory Number a valuable part of your subscription to HP&AC—by making sure the product listings are complete and accurate—by encouraging manufacturers to cooperate with complete product data in the advertising section.***
- ***Are we succeeding . . . . or have you suggestions as to how the annual Directory Edition might be improved —made more helpful? Your comments, if you didn't receive our questionnaire, are most welcome.***

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STAR VALUES

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2. **Trigger Action**—one hand operation if needed.
3. **Visi-Chek Button**—instant check for operating position.
4. **Gas Diverter**—more consistent penetration—protection to work surface.
5. **Angle-Fire Control**—to assure perpendicular penetration.
6. **Manual Safety Control**—locks tool into inoperative position.
7. **Finger-Grip Handle**—firm holding with comfort.
8. **Neoprene Grip**—fitted to the hand.
9. **Barrel Extension**—in handle for quick use.
10. **Roto-Set Safety Shield**—for easy, accurate positioning.

Ramset Fasteners, Inc.

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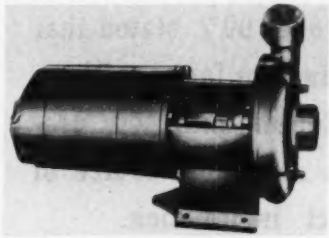
Product Patent No. 2470117. Other Patents Pending.

10 percent non-abrasive filler suspended in a non-volatile hydrocarbon vehicle. It is said by the manufacturer to be impervious to air, water, steam, oils, ammonia and hydrocarbons, and to be usable in joints or on any threaded fittings, with temperature range from −100 F through 2987 F. According to the company, it will not harden, evaporative or oxidize, and will maintain its suspension permanently under regular working or storage conditions.

Centrifugal Pump

HPAC 36—Series AM general purpose centrifugal pump designed for economical pumping of large capacities at moderate heads — Jacuzzi Bros., Inc., 5327 Jacuzzi



Ave., Richmond, Calif. It is especially suitable for use with air conditioning systems and circulating water for cooling towers. Special all-bronze pumps are available for pumping brine or other corrosive liquids. Sizes range from ¼ through 5 hp.

Finned Radiation Enclosures

HPAC 37—"Custom-Fit" enclosures designed to meet architects' or engineers' specifications for heating installations in schools, hospitals, office buildings, etc.—Radiant-Ray Radiation, Inc., New Britain, Conn. Six basic enclosure components can be combined with the company's finned radiation elements to provide installations for steam or hot water applications. All components are pre-cut and pre-punched to eliminate cutting and drilling on the job. Fasteners are concealed, corners are rounded, and panel surfaces are unbroken. A new type of heating element bracket permits expansion and contraction of the element, eliminating the danger of the bracket being torn from the wall, according to the manufacturer.

Material for Waterproofing and Corrosion Protection

HPAC 38—"Nerva-Clad" roll sheeting (of synthetic rubber, glass fiber, and asphaltic hydrocarbons) for waterproofing and corrosion protection of pipe lines, tanks, structural steel, reinforced concrete, etc. — Rubber & Plastics Compound Co., Inc., 30 Rockefeller Plaza, New York 20. It is a membrane built around a woven spun glass ply, and can be installed in one operation, the manufacturer states. The glass fiber is not affected by moisture or mildew, providing high tensile strength and dimensional stability to the membrane, and the plies of rubber compound provide an impermeable barrier, even under hydrostatic pressure, according to the company.

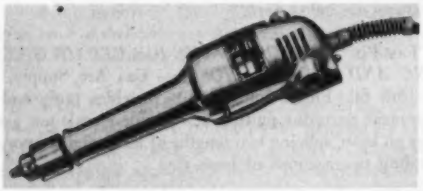
Water Vapor Indicator for Compressed Gases

HPAC 39—Improved "Aminco-Weaver" indicator designed for measuring water vapor content of compressed

gases within the range of saturation down to 0.003 milligram per liter or less, with an accuracy within 10 percent of the amount of water present — American Instrument Co., Inc., Silver Springs, Md. The vapor content of the gas being tested is determined through comparison with the content of a standard gas, saturated under pressure and expanded to atmospheric pressure. Determinations are made in two to five minutes, the manufacturer states. It can be used to determine dryness of refrigerants, etc.

Hand Grinders

HPAC 40*—Three new hand grinders for use with mounted wheels and points — Skilsaw, Inc., 5033 Elston Ave., Chicago 30. One model has a speed of 20,000 rpm,



and a 5/32 in. capacity geared chuck. Another, with the same speed, comes with 1/8 and 1/4 in. collet chucks. The third has the same size chucks, but a speed of 36,000 rpm. All are less than 10 in. in length and weigh about 2 lb.

EQUIPMENT BRIEFS

ELECTRONIC RELATIVE HUMIDITY INDICATOR which is sealed inside vapor-proof containers with stored equipment and acts as a sentinel to warn of excessive humidity — Minneapolis-Honeywell Regulator Co., Station 40, Wayne & Windrim Aves., Minneapolis. Moisture content of the package can be determined at any given time by plugging a portable electron meter into an outside connection, and reading directly from it. Primary application is in safeguarding packaged military equipment. The device is capable of detecting changes in relative humidity as small as 1/100 of 1 percent.

"Leak Lock" *PROTECTIVE COATING* for protecting process equipment, piping, tanks, fittings, etc., against a wide variety of chemicals, including chlorinated solvents, "Freons," etc. — Highside Chemicals Co., 10 Colfax Ave., Clifton, N. J. It employs a plastic that is designed to be effective at temperatures from subzero to 400 F. No curing is required. It may be brush, spray, or dip applied.

"Kaylock" lightweight *SELF-LOCKING NUT* now available in a floating anchor nut type — The Kaynar Mfg. Co., Inc., Kaylock Div., Engineering Dept., 820 E. 16th St., Los Angeles. It comprises a threaded nut portion and a retaining shell, providing a 1/16 in. radial movement between the nut and the anchoring portion. Lighter than its corresponding fixed anchor nut, it is identical in outline and size to fixed anchor nuts of comparable thread size, permitting interchangeability.

MAGNETIC FIXTURE TO AID ULTRASONIC THICKNESS TESTING — Branson Instruments, Inc., 430 Fairfield Ave., Stamford, Conn. The fixture holds the searching unit of the "Audigage" thickness tester against

Cyclotherm Steam Generators means *Quick Steam* when called for. This reduces fuel consumption during "coming up" periods and permits continuous, quick adjustment to load changes. The Cyclotherm Boiler is able to deliver steam faster because of its extremely high heat transfer and the fact that it has much greater water circulation since the combustion chamber is radiating heat evenly in all directions and along its entire length.

If your steam requirements have a tendency to change at different times of the day, the most economical and efficient boiler you can install is a Cyclotherm.

REMEMBER—Full power operation from a cold start in 15 to 20 minutes. Savings up to 50% on maintenance. Great fuel operational savings.

Boilers are designed for oil or gas operations from 18 thru 500 h.p., 15 to 200 lbs. operating pressure.

The Cyclotherm meets all state requirements and is built in accordance with A.S.M.E. and National Board Standards and bears the label of Underwriters Laboratories, Inc.

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DIVISION UNITED STATES RADIATOR CORP
DEPARTMENT 26 OSWEGO, NEW YORK

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Switch to BLACK & DECKER POWER

BLACK & DECKER ELECTRIC PORTO-SHEARS* cut sheet metal too tough for snips. Speed up jobs where snips are slow. Save you time and cut your costs on hundreds of jobs. Fast, powerful shearing action eliminates hard muscular strain. Easy to follow straight lines, irregular patterns, curves to small radius because *cutting action is always visible!* Two models: 12-gage and 16-gage capacities.

BLACK & DECKER ELECTRIC HAMMERS speed up such jobs as drilling holes for toggle bolts in concrete and brick—cutting mortar out of joints to install flashings — cutting through walls, shaping timbers, channeling floors. High-speed, amazingly husky, deliver thousands of sharp, positive hammer blows per minute. Drive star drills, speed bits, chisels, many other tools. Light, compact, completely self-contained, require no transformer or extra equipment. Four models: rated by drilling capacity in concrete for ½", ¾", 1⅛", 2".

SEE YOUR NEARBY B&D DISTRIBUTOR for demonstrations, full details, expert help in selecting the right tools for your jobs. Write for free catalog to: THE BLACK & DECKER MFG. Co., 628 Pennsylvania Ave., Towson 4, Maryland.

*Trade Mark Reg. U. S. Pat. Off.

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LEADING DISTRIBUTORS EVERYWHERE SELL

Black & Decker PORTABLE ELECTRIC TOOLS

the plate being tested, assuring good contact and preventing accidental shifting during tests, the manufacturer states.

Improved line of *MOLDED RUBBER HOSE* in five basic types, now incorporating such components as rayon braids instead of cotton, and tubes and covers of both natural and synthetic rubber — Thermoid Co., Whitehead Rd., Trenton, N.J.

"Thermo-Sash" *ALUMINUM WINDOW FRAME* built to match double-paned insulating glass — Kesko Products, Inc., Bristol, Ind. It is designed to eliminate condensation and frost on the interior metal surfaces at normal room temperatures and humidity when outside temperatures are below zero.

"Fast-Fix" *KIT FOR ON-THE-JOB REPAIR OF CUTTING AND WELDING HOSE* — Gas Arc Supply, 223 N. 16th St., Philadelphia 2. It provides tools and replacement parts for putting new nipple-ferrule-nut assemblies on hose, splicing two lengths of hose, and temporarily coupling two sections of hose.

"Sonic-Ray" *PORTABLE SPACE HEATER* for temporary heating — Bica Co., 1170 N. State St., Girard, Ohio. It burns propane gas, has an output of from 85,000 to 150,000 Btu per hr, and operates from 40 to 63 hours on a 100 lb tank of gas, the manufacturer states.

INDUSTRIAL HOSE REEL which can be mounted out of the way of operations — Zierden Co., 3815 S. Kinnic, Milwaukee. Various types of mountings (overheads, island, etc.) are available.

'Sno-Breeze" *TRAILER COOLER* (Model FTD-2100) which cools, washes, filters air of pollen and dust, and removes odors — Palmer Mfg. Corp., 2200 W. Fillmore, Phoenix. Designed to fit over the ceiling ventilator, it can be installed in 15 minutes, the manufacturer states.

WE HEAR THAT . . .

More than 850 employees, friends, customers, distributors and suppliers were guests of *YARNALL-WARING CO.*, Philadelphia, at a recent "Open House." Featured attraction was a series of conducted tours through the expanded plant and new office buildings.

A. C. SMITH & CO., INC., Newburgh, N.Y., this year celebrates its 75th anniversary.

GENERAL ELECTRIC CO., Bloomfield, N.J., is offering a five-year protection plan on all packaged air conditioners for commercial, industrial and office use. In addition to giving a one-year warranty on the complete conditioner, the company will repair or replace any part of the refrigeration compressor free of charge, if it fails due to normal use or service during the ensuing four years.

Among the ten technical leaders to receive awards of merit from *THE AMERICAN SOCIETY FOR TESTING MATERIALS* during the 50th anniversary meeting were *J. J. KANTER*, directing engineer, engineering labs., Crane Co., Chicago, and *RAY THOMAS*, staff engineer, Carbide and Carbon Chemical Div., Union Carbide and Carbon

Corp., S. Charleston, W. Va. Mr. Kanter was recognized especially for work in Committee A-1 on steel, and also in other ferrous and non-ferrous metals fields. Mr. Thomas was recognized for notable work in Committee C-16 on thermal insulating materials.

The new address of *WHEELCO INSTRUMENTS DIV.* (formerly Wheelco Insrtuments Co.), *BARBER-COLMAN CO.*, is Rockford, Ill. All manufacturing and operating facilities now have been transferred there.

The warm air heating catalog (A51), and *Ratings Data and Dimensions*, two publications of *AMERICAN RADIATOR & STANDARD SANITARY CORP.*, Pittsburgh, have won top honors in the 1952 product literature competition co-sponsored by the American Institute of Architects and The Producers' Council, Inc.

THE BABCOCK & WILCOX CO., New York, has developed an oil additive to relieve boiler slagging by modifying the fuel ash deposit to make it more readily removable. In a typical application at the Inglis Station of the Florida Power Corp., the additive is mixed, batch-wise, in heated fuel oil, which is kept agitated by a motor-driven stirrer and other means.

About 100 engineers attended meetings held recently at Wilmington, Del., and Philadelphia, where developments in heat transfer surface were exhibited by *THE TRANE CO.*, La Crosse, Wis. Another group, about 25 Wisconsin steamfitter apprentices, recently toured the company's factories under the sponsorship of the Wisconsin Schools of Vocational and Adult Education.

DR. LEONARD GREENBURG, of the New York State Dept. of Labor, was designated the 1952 winner of the Cummings Award, highest honor of the *AMERICAN INDUSTRIAL HYGIENE ASSOCIATION*, for his work in the field of industrial health and safety.

LIBBEY-OWENS-FORD GLASS CO., Toledo, has announced to its distributors a 30 day delivery schedule on small and medium cut sizes in heat absorbing polished plate glass for air conditioned buildings.

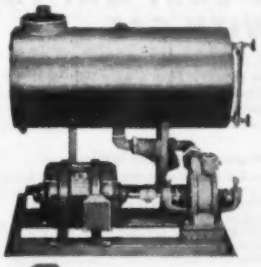
DALLAS AIR CONDITIONING CO., Dallas, distributor for *YORK CORP.*, York, Pa., is celebrating its 20th anniversary this year.

A new 20-minute color and sound motion picture featuring the development and application of internally-geared electrical motors has been produced by *U. S. ELECTRICAL MOTORS, INC.*, Los Angeles. It is designed for electrical and maintenance engineers.

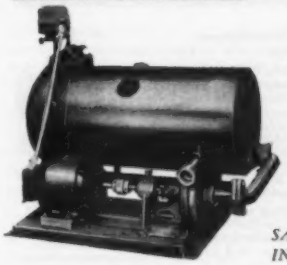
D. E. McCULLY, heating equipment representative, has moved to a new building at 1903 Jones St., Omaha 2.

A meeting for 130 Wisconsin dealers was held recently at the plant of the *L. J. MUELLER FURNACE CO.*, Milwaukee. It featured a plant tour.

Like the dependable Skidmore Pump, which operates under all types of conditions, the men that build them are on the job tool Day in and day out, all types of Skidmore Pumps are flowing down the production line for defense and peace time orders. Whether your requirements call for the TM Turbine type pump or the HS Condensate Horizontal type pump, these and other Skidmore Pumps are on the job, performing dependably everyday.



Send for Bulletin No. 17 Type TM High Pressure Turbine Pump. Pressures up to 150 lbs. and boilers to 250 H. P.



Send for Bulletin No. 14-A Type HS Condensate Pump. Capacities from 1,000 to 65,000 sq. ft. E.D.R. Pressures from 10 to 75 lbs.

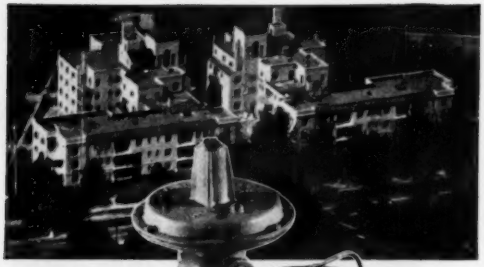
Write for Bulletins! Skidmore has a heating pump designed for every installation. Get the facts now!

SALES REPRESENTATIVES IN PRINCIPAL CITIES.

MANUFACTURING QUALITY PUMPS SINCE 1921

SKIDMORE PUMPS

ST. JOSEPH, MICHIGAN



Lo-BLAST Burners heat this huge Cincinnati apartment building.

FOR EVERY TYPE OF BUILDING

LO-BLAST

IS THE LOW-COST WAY TO HEAT WITH GAS

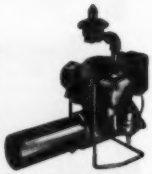
Every dollar trimmed from operating expense shows up on the profit side of the ledger. That's why fuel-saving Lo-BLAST Power Gas Conversion Burners are the sensible selection for buildings which must produce income . . . or for home owners concerned with keeping living costs down.

Lo-BLAST operating cost averages 10% less

The Lo-BLAST principle of combustion utilizes an extremely quiet, low speed blower to provide perfectly controlled primary and secondary air. Hence operation is always independent of natural draft conditions—makes the Lo-BLAST ideal for down-draft boilers. Combustion is completed in an incandescent firebox, with radiant heat applied to the crown sheet as well as side walls. There's no combustion roar—the flame is soft and *quiet!*

High efficiency on intermittent operation

Lo-BLAST Burners show only a small drop in over-all efficiency when changing from constant to intermittent operation. This is the reason for Lo-BLAST fuel economy, since intermittent operation is the normal condition for any heating plant.



Lo-BLAST Economite

Residential size—70,000 to 500,000 BTU—with all the fuel-saving features of the standard Lo-BLAST.

Factory-tested on gas, shipped completely assembled

Installation and servicing are easy *because there's nothing in the firebox but the fire!* All units have standard controls with positive acting pilot and blower safetys.

Capacities from 70,000 to 20,000,000 BTU input. Write for engineering data.

MID-CONTINENT
METAL PRODUCTS CO.
1960 N. Clybourn Ave., Chicago 14, Ill.

THE LUNKENHEIMER CO., Cincinnati, was one of two exhibitors receiving awards for the most informative displays at the 37th annual convention of the *NATIONAL ASSOCIATION OF PURCHASING AGENTS* held recently in Atlantic City.

FRANK H. ADAMS, president of *SURFACE COMBUSTION CORP.*, was recently presented with a glass key to the city by the mayor of Toledo, in a ceremony marking the 25th anniversary of the present Toledo plant, and Mr. Adams' 40 years of service with the company.

There will be a major expansion of the Watson, Calif., plant of *JOHNS-MANVILLE CORP.*, New York, for the production of industrial insulations. Construction of the building will be completed in the early fall of 1953, it is expected. It will enclose about 100,000 sq ft of floor space.

BORG-WARNER CORP., Chicago, has acquired *REFLECTAL CORP.*, producer of aluminum foil blanket-type insulation, which will be operated as a subsidiary, with executive offices in New York, and a plant at Hudson Falls, N.Y. The products will be distributed through the combined sales organizations of both Reflectal and the Ingersoll Products Div. of Borg-Warner. *R. S. INGERSOLL*, president of Ingersoll Products, also will serve as president of the new subsidiary.

COMMERCIAL FILTER CORP. has moved from Boston to its new factory in Melrose, Mass. It consists of three buildings, with a total area of 135,000 ft.

A new placement program for recruiting and training college-graduated engineers has been inaugurated by *WORTHINGTON CORP.*, Harrison, N.J. The program is under the supervision of a newly-created personnel and training department, managed by *J. J. THOMPSON*. The company has released a new 20 minute sound filmstrip, *The Vertical Turbine Pump Story*, which points out suitable applications of the pumps other than deep wells.

DAVIS PIPING CORP., installation contractor for heating systems, process piping, etc., is at its new location, 220 E. 149th St., New York 51.

ROBERT H. COLLINS, formerly of Omaha, has become a full partner in the Gaines Co., Los Angeles, which will now be known as *GAINES-COLLINS CO.* The company has acquired the 28 year old *QUIJADA TOOL CO., INC.*, Los Angeles, manufacturer of pipe and conduit threaders, cutters for pipe, conduit and tubing, and similar tools.

The Atlantic County, N.J., Heating and Cooling Association, at a recent meeting, voted formally to affiliate, as a local chapter group, with *OIL-HEAT INSTITUTE OF AMERICA, INC.*, New York. Fifteen members of the group's membership of about 25 were present, including fuel oil dealers, oil-burning equipment dealers, and sup-

plier representatives. *JOSEPH A. HUGHES* was re-elected as president of the group, with *ROBERT LIPPMAN*, vice president, and *FRED J. SITHENS* secretary-treasurer.

"Aireactor" is the new trade name under which the chemical odor neutralizer previously known as "Renovair" is now being marketed. The product is manufactured by the Correctair Div., *BOYLE-MIDWAY, INC.*, New York.

Recently, the "Ultralite" glass fiber insulation of *GUSTIN-BACON MFG. CO.*, Kansas City, Mo., was used in a cement plant to increase the efficiency of dust collectors which was being reduced by moisture resulting from condensation. During cold months, this moisture caused clogging of the filter bags. The insulation was applied, and held in place on the collectors with an adhesive covered with chicken wire and a trowled-on mastic which acts as a vapor barrier.

More than 100,000 architects, heating and ventilating engineers, and others, have viewed the "Parade of Progress," a 19 month caravan of the automatic control devices of *MINNEAPOLIS-HONEYWELL REGULATOR CO.*, Minneapolis.

1952 marks the 25th year in which *DOLE MFG. CO.*, Chicago, is producing its "Vacuum Plate" evaporator, which was designed and patented by the company.

The *AMERICAN GAS ASSOCIATION* has announced the fifth annual progress award for gas summer air conditioning. Cash prizes and trophies will be awarded to three gas utilities which, in the opinion of the judges, made the most outstanding contributions during 1951-1952. The awards, totalling $1000, are sponsored by *SERVEL, INC.*, Evansville, Ind.

H-B INSTRUMENT CO. will soon occupy its newly acquired plant at American and Bristol Sts., Philadelphia. These larger facilities represent the fourth move for the company since its founding in 1916.

The annual sales conference of *BUSH MFG. CO.* was held recently in West Hartford, Conn., with the company's sales engineers from throughout the country as well as its export men in attendance.

DRAYER-HANSON, INC., Los Angeles, has purchased *JACKSON ENGINEERING CO.*, Montebello, Calif., producers of aerial coolers and shell and tube heat exchangers for the petroleum and chemical industries. *GORDON M. JACKSON* will join Drayer-Hanson as vice president of the industrial division.

JOHNSON SERVICE CO., Milwaukee, has completed two new four-story additions to its East Michigan St. plant. The additional space totals 100,000 sq ft. Ultimately, it will permit expansion of facilities for manufacturing control equipment, but for the present, most of the space will be used for machining and assembling apparatus involved in the defense effort.

Five of the Clarage Heavy Duty Fans in the air conditioning systems of The Upjohn Company's new plant in Kalamazoo. Korfund Twin Rail Fan and Motor bases were used to prevent vibration and noise transmission into the supporting steel deck and the duct work.

...by installing over 200 fans and motors on Duplex bases

Upjohn has long been known for extreme care in the production of fine pharmaceuticals. Therefore, in building their new plant, quiet, spotless working conditions were a prime consideration. This called for 120 complete air conditioning systems with 324 Clarage Heavy Duty fans.

To conserve floor space, The Austin Company, Engineers and Builders planned the installation on suspended platforms and structural steel members under the roof.

Korfund Twin Rail Bases were specified so that no vibration or noise could reach the working areas through the steel decks or through the ducts, and to simplify the installation.

Complete adjustability of the Duplex Twin Rail separate bases for fan and motor made it easy to take care of variations in drive center distances, motor positions and other variables; and the exclusive built-in chocks in these bases guaranteed permanent alignment.

For installation of fans, pumps, compressors, refrigerating and other types of mechanical equipment for both normal and critical operating conditions, basic isolation recommendations are given in Korfund Bulletin G-104. See Sweet's Catalog Files, or write for your free copy today.

If you have a problem, we will be glad to submit recommendations without obligation. A half century of experience is at your disposal. Representatives in principal cities.

THE KORFUND COMPANY, INC.
Thirty Second Place, Long Island City 1, N.Y.
In Canada: 2040 Victoria St., Montreal 2

For the Summer Heating Tune-up

Most maintenance engineers believe in a summer check-up of their heating systems. Barnes and Jones make this check-up easy by providing a means for testing all steam traps, and for replacing the actuating units of any make trap with a wrench.

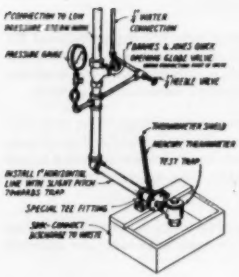
The booklet illustrated above shows how you can detect any inefficiencies in your heating system, and how to replace all defective trap units at low cost and with little time.

The B & J cage unit replaces everything except the trap casing and pipe threads. You don't have to ream out the trap seats.

A new corrosion resistant seat is part of the double diaphragm unit which is correctly and permanently adjusted before leaving the factory.

All you need to do is to remove the old elements and seats and drop in the new B & J cage unit. Made for all sizes, pressures and makes of vapor and vacuum traps up to 65 pounds.

TEST SET



If you are in doubt about your traps, get this B & J testing set which will show in a minute which steam traps are not operating efficiently. If your system has been installed five or ten years, it might be better to put in all new B & J cage units which really cost less than the cost of removing and testing.

Get rid of those phone call complaints of noise, half hot and too hot radiators this fall. Get a supply of the inexpensive B & J cage units. Ask for bulletin R44.

1-B

B&J for QUALITY

Barnes & Jones INCORPORATED

REPRESENTATIVES IN PRINCIPAL CITIES

BOSTON 30, MASSACHUSETTS

WHO'S WHAT

R. S. STEVENSON has been elected executive vice president of *ALLIS-CHALMERS MFG. CO.*, Milwaukee. He has been with the company since 1933, most recently as vice president in charge of the tractor division.

The new chief engineer for *AIR-MAZE CORP.*, Cleveland, is *RICHARD E. BROWN*, formerly assistant chief engineer, who has been with the company for the past ten years.

KENNARD CORP., St. Louis, has appointed *E. JOHN HILL* as director of research and development. He was formerly with The Trane Co., La Crosse, Wis., as manager of the research and development laboratory and a member of the development committee.

A new slate of officers was elected for the ensuing year at the recent 35th annual meeting of the *STOKER MANUFACTURERS ASSOCIATION*. *LeROY C. DUBS*, Canton Stoker Corp., was elected president, succeeding *C. T. BURG*, Iron Fireman Mfg. Co. *B. O. FINK*, Auburn Foundry, Inc., is the new vice president, and *HOWARD B. SCOVILLE*, Cotta Transmission Co., is now secretary-treasurer. *MARC G. BLUTH*, Chicago, was re-appointed executive secretary.

REMINGTON AIR CONDITIONING DIV., Auburn, N. Y., has appointed *M. L. JUDD* as general sales manager to succeed *E. A. BONNEVILLE*, recently resigned. Mr. Judd has been with U. S. Radiator Corp. since 1948. *RUSSELL A. JOHNSON* has been named military specialist to aid in expanding the division's military and industrial business. He has been with Houdaille-Hershey Corp.

O. D. METZ is the new manager of motor sales for *EMERSON ELECTRIC MFG. CO.*, St. Louis, succeeding *WILLIAM R. FRASER* who has retired under the company's pension plan. *W. H. THIAS* is the new assistant manager of motor sales, and *R. G. BARDON* is assistant manager of merchandise sales.

MAURICE RODERICK EASTIN has been appointed assistant manager, Control Sales Div., *PERFEX CORP.*, Milwaukee. At the time of his joining the company, he was manager, Transportation Div., Minneapolis-Honeywell Regulator Co.

Officers recently elected for the ensuing year by *THE MICHIGAN ENGINEERING SOCIETY*, Detroit, are: president, *SEWELL H. DOWNS*, Clarage Fan Co.; vice president, *WILLIAM N. KITCHEN*, Kellogg Co.; secretary, *JOSEPH B. JEWELL*, director of public works, Pontiac, Mich.; treasurer, *SAMUEL D. PORTER*, Porter & McNamee; and director-at-large, *D. BRADFORD APTED*, Grand Rapids Plaster Co.

M. E. ZIEGENHAGEN has been named advertising and sales promotion manager, *WORTHINGTON CORP.*, Harrison, N. J. He had been with General Electric Co. *RALPH M. WATSON* is now director of research for the corporation, a post he assumed after the retirement of *PAUL DISERENS* recently. Since 1945, Mr. Watson has been assistant to the vice president in charge of engineering. Mr. Diserens will continue with the corporation in a technical consulting capacity.

DON PRESTON has been named chief engineer, *E. B. WIGGINS OIL TOOL CO., INC.*, Los Angeles.

ACME INDUSTRIES, INC., Jackson, Mich., has appointed *R. E. MERCER* as director of merchandising. Formerly, he was national sales manager for the Kalamazoo Stove and Furnace Co. *CARL MILLSOM*, who heads the company's Flow-Cold Div., has, in addition, been appointed sales manager for the Air Conditioning and Refrigeration Div.

JAMES H. BINGER has been elected vice president of *MINNEAPOLIS-HONEYWELL REGULATOR CO.* Since 1950, he has been vice president and general manager of the company's Belfield Valve Div., Philadelphia. His new headquarters will be in Minneapolis. *PAUL OZANNE* is now manager of the sales and economic analysis division of the company's marketing research department. Since 1950 he has been chief statistician in the comptroller's office of the U.S. Army at Camp Cooke, Calif.

FRANK L. MAGEE, vice president and general production manager, *ALUMINUM CO. OF AMERICA*, Pittsburgh, has been elected a director of the company. *J. R. D. HUSTON* is retiring as secretary, a post he has held for eight years. He is succeeded by *ALFRED M. HUNT*, a member of the board of directors, who has been assistant secretary.

GEORGE K. IWASHITA has been appointed general manager of the newly-established commercial products department, Air Conditioning Div., *GENERAL ELECTRIC CO.*, Bloomfield, N.J. Formerly, he was manager of product planning for the division.

JACK BINDER has joined the research and development division of *PITTSBURGH CORNING CORP.* at Port Allegany, Pa., as a product development engineer specializing in cellular glass insulation. He was previously with A. M. Byers Co.

HERBERT L. LAUBE, Remington Corp., has been elected to head the *ROOM AIR CONDITIONER SECTION, AIR CONDITIONING AND REFRIGERATING MACHINERY ASSOCIATION*, Washington, D. C., *H. B. DONLEY*, General Electric Co., is vice chairman, and *W. L. McGRATH*, Carrier Corp., was reappointed to serve as chairman of the engineering committee.

FRED WELDON, formerly regional manager for the eastern division of *GENERAL CONTROLS CO.*, Glendale, Calif., has been appointed sales manager of the company, with additional responsibility for management of the new

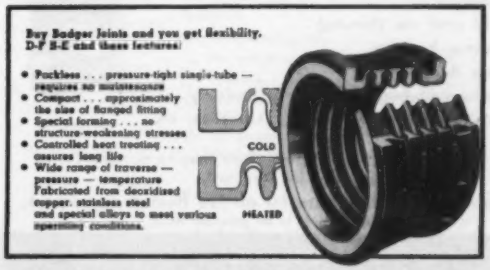
how flexible CAN YOU GET!

WITH EXPANSION JOINTS IT'S Badger

In the national pastime there are new stars every year — but when it comes to expansion joints Badger is a consistent leader in the field year in and year out.

The built-in flexibility and long life of Badger Expansion Joints assures protection against damage to equipment by absorbing the expansion and contraction in piping due to temperature changes.

D-F S-E Directed-Flexing Self-Equalizing: an exclusive feature of Badger Expansion Joints. The flexing of the corrugations is progressively directed over each segment of each of the all-curve corrugations by correspondingly shaped self-equalizing rings. Localized stresses are eliminated insuring a more flexible longer lasting joint.

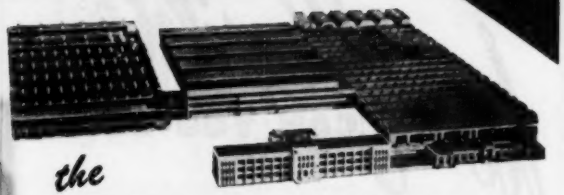

Buy Badger Joints and you get flexibility, D-F S-E and these features!
• Packless . . . pressure-tight single-tube — requires no maintenance
• Compact . . . approximately the size of flanged fitting
• Special forming . . . no structure-weakening stresses
• Controlled heat treating . . . assures long life
• Wide range of traverse — pressure — temperature
Fabricated from deoxidized copper, stainless steel and special alloys to meet various operating conditions.
COLD
HEATED

BADGER MANUFACTURING COMPANY

Original and Sole Manufacturer of Badger Expansion Joints

230 BENT STREET • CAMBRIDGE • MASS.

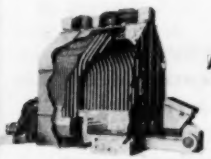
Specify LEE



the
GLENN L. MARTIN COMPANY does
(BALTIMORE, MARYLAND)

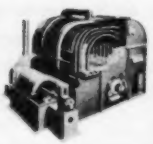
Throughout the entire Glenn L. Martin plant in Baltimore, there are Lee Heaters which were completely engineered for a partiular need.

Lee Heaters heat, ventilate and supply make-up air to over 5,000,000 sq. ft. of space throughout the plant, and have the capacity of the amazing figure of 300,000,000 BTU with a total blower capacity of 3,000,000 CFM.



Model VTH

THERE'S NO HEATING OR AIR-REPLACEMENT PROJECT TOO LARGE FOR LEE HEATERS.



Model TSE

Model HD

LEE HEATERS FOR:

- space heating
- make-up air
- coal and ore thawing
- process heating
- crop drying
- de-humidifying, de-fogging, de-icing
- comfort heating — schools, churches, etc.

LEAN TO LEE . . . Specify Lee they're economical . . . you get more heat for less cost.

Complete engineering data for all Lee Heaters on request.
Representatives in all principal cities.

SPECIFY LEE
the completely engineered heater

LEE CORPORATION
(HEATERS SINCE 1918)
1001 TATNALL STREET, WILMINGTON, DELAWARE
BALTIMORE, MD. CHICAGO, ILL.

Skokie, Ill., factory. *WILLIAM L. KELL*, assistant sales manager, has been additionally assigned as manager, Heating Controls Div. *R. D. GRAYSON* is now manager, Appliance Controls Div.

CLOUD WAMPLER, president, *CARRIER CORP.*, Syracuse, has been elected one of the directors (for a three-year term) of the *AMERICAN MANAGEMENT ASSOCIATION*, New York.

CARL B. JANSEN, president, *DRAVO CORP.*, Pittsburgh, has been elected a trustee of *UNION COLLEGE*, Schenectady, N.Y.

A technical sales unit, designed to render service on heat transfer and product fabrication problems, has been established by *WOLVERINE TUBE DIV.*, Calumet & Hecla Consolidated Copper Co., Detroit. Heading the unit is *C. H. KUTHE*, formerly manager of the division's product development department. He will be assisted by *L. J. BONACOR*, *R. B. DAVIS*, and *H. C. FLESCH*.

L. A. BARRON, engineer with *VERMICULITE INSTITUTE*, Chicago, has been named manager of the new technical service department, created to do liaison work between the industry and allied fields, as well as with government agencies and departments. Mr. Barron has been with the institute for the past three years.

The new manager, original equipment sales, Crise Controls Div., *ACRO MFG. CO.*, Columbus, is *E. V. BISHOFF*, formerly with Rockwell Mfg. Co.

THE FOXBORO CO., Foxboro, Mass., has appointed *W. H. T. FURRY* as associate director of its training school, which provides training facilities in industrial instrument engineering. Mr. Furry has been training coordinator at the Atlantic Refining Co., Philadelphia, and has taught at Pennsylvania State College and the Philadelphia section of the Instrument Society of America.

Three executives of *WIGTON-ABBOTT CORP.*, Plainfield, N. J., have been advanced to new positions. *IRWIN BORSUK*, formerly chief engineer, is now director of engineering. *WALTER V. COLEMAN* is now chief engineer, and *BEN BELKIN* has been named chief architect.

DEAN STOCKETT EDMONDS, senior member of Pennie, Edmonds, Morton, Barrows and Taylor, New York law firm, has been elected to the board of directors, *FLEXIBLE TUBING CORP.*, Guilford, Conn.

JAMES F. OATES, JR., chairman and chief executive officer of The Peoples Gas Light and Coke Co. of Chicago, has been elected a director of the *AMERICAN GAS ASSOCIATION*. He fills the unexpired term of *FRANK C. SMITH*, recently elected a vice president of the association. *ROBERT W. HENDEE*, president, Colorado Interstate Gas Co., and former president of the association, has been elected president, *INTERNATIONAL GAS UNION* at the recent conference in Brussels, Belgium.

New Resistance Thermometers Accurately Indicate and Control Low Temperatures

TEMPERATURES FROM −100 F to +300 F can now be accurately indicated and controlled with General Electric's new line of resistance thermometers. They indicate accurately within ½ of 1 per cent full scale. Any change in temperature equivalent to 1/10 of 1 per cent full scale starts immediate control action.

Normal changes in humidity or room temperature do not affect the exactness of control. Neither does a change in control voltage. Sturdy, simple construction assures reliable operation under severe operating conditions.

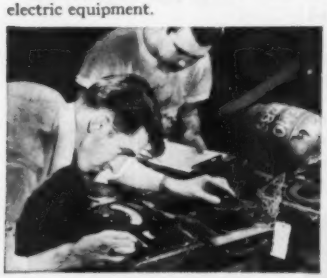
NARROW TEMPERATURE SPANS, as small as 90 degrees, are available anywhere in the −100 F to +300 F range. You can buy four types of resistance thermometers—indicators, protectors and two- or three-position controllers—for either flush or surface mounting.

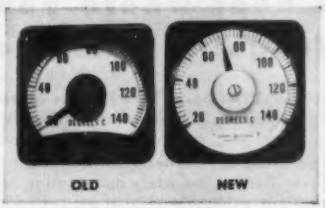
For complete information, mail the coupon below.

G-E Thermocouple Potentiometer Accurate Within 0.2% Full Scale

This thermocouple potentiometer measures temperature in locations inaccessible to glass-stem thermometers. Readings can be taken in rapid succession and are accurate to within ±0.2% of full scale.

Typical applications include refrigerator-development work, oil-burner and air-conditioning tests, steam temperature measurements, and heat-run tests on electric equipment.





New Shadow-proof Temperature Indicators Are Easier to Read

Temperatures from −100 F to +300 F can now be accurately indicated with General Electric's new line of resistance temperature indicators. These instruments can be read from almost any angle. The dial is set forward, flush with the front of the case. A protruding convex-type glass front provides clear illumination. No more cover overhang; no more shadows caused by overhead lighting. Two sizes available—4¾ and 8¼ inches. Check coupon.

Easy to Use G-E Hand Pyrometer Available With Two Scale Ranges

Simply flick a switch to change scale ranges on General Electric's new Type FH-1 hand pyrometer. This unique feature in the new FH-1 cuts testing time, eliminates use of several pyrometers.

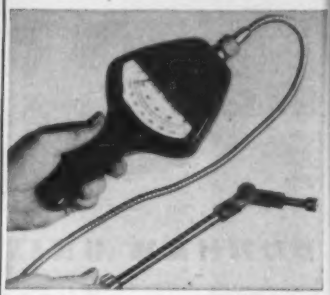
The Type FH-1 hand pyrometer is designed for rapid and convenient measurement of surface, liquid gas and molten-metal temperatures.

THREE INTERCHANGEABLE TIPS

A surface tip, an immersion tip for liquids and molten metals, and a 2-prong contact are supplied with the FH-1. In addition, a carrying case and flexible and rigid arms are provided for the FH-1. Both tips and extension arms are interchangeable in seconds.

AUTOMATICALLY COMPENSATED

Readings can be made directly for either scale of the instrument. With automatic cold-end compensation the FH-1 needs



no manual adjustment for variations in temperature in either the instrument or surrounding atmosphere.

See your nearest G-E representative today for complete information on the FH-1, or check coupon for GEC-836. Price of equipment shown in photo is $118.17*

**Manufacturer's Suggested Retail Price*

SECTION A602-242, GENERAL ELECTRIC SCHENECTADY 5, N. Y.

Please send me the following bulletins: Indicate:

√ **for reference only**

× **for planning an immediate project**

☐ **Resistance Thermometer (GEC-835)**

☐ **Thermocouple Potentiometer (GEC-245)**

☐ **Temperature Indicators (GEC-565)**

☐ **Hand Pyrometer (GEC-836)**

NAME .....

COMPANY .....

STREET .....

CITY ..... **ZONE** ..... **STATE** .....

GENERAL ELECTRIC

Outstanding DUNHAM design features

(A) Sturdy Steel Casing gives maximum rigidity and freedom from vibration. Rust resistant.

(B) Improved Header Design requires fewer solder joints; assures uniform heat distribution; equalizes expansion through tubes.

(C) Adjustable Motor Bracket permits perfect centering of fan in one-piece fan shroud.

DUNHAM UNIT HEATERS

Throw heat where you want it ...provide quiet operation

With Dunham Horizontal Discharge Unit Heaters overhead, you can solve many space heating problems . . . comfortably . . . economically . . . and quietly.

Comfortably because these heaters are designed and constructed to give most effective heat distribution while maintaining perfect balance between air volume, velocity and final air temperature.

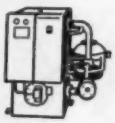
Economically because sturdy Dunham heaters require virtually no maintenance while piling up years of fully dependable service.

Quietly because rubber-mounted motors minimize vibration and noise; fans operate at relatively slow speeds.

You can depend on Dunham products for quality performance, regardless of your heating equipment needs. Dunham Vacuum Pumps, for example, pull *up to 26 inches* of vacuum year after year. Dunham Convectors continue to provide comfortable, economical heat with no care other than periodic cleaning.

For further information on Dunham Unit Heaters, write for Bulletin 1301-2. Similar literature available on other products.

Convector Radiation



Vacuum Pump

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DUNHAM heating systems and equipment

Vari-Vac Differential Heating • Baseboard Radiation • Fin-Vector Radiation • Condensation Pumps
Vertical Discharge Heaters • Traps • Valves

RICHARD H. CLAY is now manager, Engineering Service Dept., *A. M. BYERS CO.*, Pittsburgh. Previously, he was with the Ingalls Iron Works.

IN THE TERRITORIES . . .

For *JENKINS BROS.*, New York—*HERBERT H. JAYNES* is New England manager, succeeding *ANTHONY D. WEBER*, retiring after 44 years with the company. Mr. Jaynes has been field representative and assistant Boston manager.

For *EDWARD VALVES, INC.*, East Chicago, Ind.—*REED & KING, INC.*, Foshay Tower, Minneapolis 2, is sales representative for Minnesota, North Dakota, South Dakota and northwestern Wisconsin.

For *YORK-SHIPLEY, INC.*, York, Pa. Three men promoted to regional managerships: *E. A. SPANGLER*, for the middle western states, headquarters in Milwaukee; *R. B. SNYDER*, succeeding Mr. Spangler as manager of the middle Atlantic region, and also directing the wholesale sales operation of the distributorship in central Pennsylvania, with headquarters in York, Pa.; and *CLARENCE RANDALL*, for New England, also supervising retailing distributor operations in the metropolitan New York market, headquarters in Passaic, N. J.

For *GENERAL CONTROLS CO.*, Glendale, Calif.—*RUDY ROEDDER* is western manager, *REFRIGERATION CONTROLS DIV.*, with headquarters at the Skokie, Ill., plant. *RUSSELL STRONGMAN* is manager, New York City branch office, and will also supervise the Newark, N. J., warehouse and branch office operation. The company has opened an office in Hartford, Conn., which will be headed by *JOE CRANDLEY*, formerly with the Baltimore office. His new position as district manager entails administrative direction of the Massachusetts subsidiary, Automatic Controls Co. *FRANK MURRAY* is now in charge of the Boston office.

For *WORTHINGTON CORP.*, Harrison, N. J.—two new branch managers: *PAUL J. FOLEY* heads the Kansas City office, succeeding *W. R. KENNEDY*, who has been named a consultant to that office; *WILLIAM M. FINE* heads the Milwaukee office.

For *TUBULAR PRODUCTS DIV., THE BABCOCK & WILCOX CO.*, Beaver Falls, Pa.—*DAVID W. JONES, JR.*, who handles the division's complete line of products in the Rocky Mountain area, has opened new offices in the Goby Bldg., 1321 Bannock St., Denver.

For *ACRO MFG. CO.*, Columbus — *M. S. FELTZ* is district sales manager, Chicago territory, to handle controls and switches.

For *KAYLO DIV., OWENS-ILLINOIS GLASS CO.*, Toledo—*THE HOMESTEAD INSULATION CO.*, 45 Granby St., Hartford, is distributor-applicator for heat insulation.

THIS peaceful scene symbolizes the relaxing atmosphere of New York's Hotel Pierre, famous for gracious, restful living. No cooling tower noise is permitted to disturb slumber because Industrial Sound Control engineers, using ISC "Soundmetal" panels, effectively suppressed all noise from this source.

Cooling tower noise can mean loss of rental revenue, tenant dissatisfaction, bad public relations and, in extreme cases, injunctions which mean shutting down the system. Specifying noise suppression as part of the original installation generally saves money and headaches in the long run.

Specify ISC's "Soundmetal" panels, because every ISC installation is individually engineered to the specific noise problem . . . and because ISC, the pioneer in industrial noise control, has the experience and the engineering skill to assure your complete satisfaction.

Write today for free booklet "Sound Facts".

Midwestern Distributor: Midwest Industrial Sound Control, Inc. 1455 North Pennsylvania Street, Indianapolis 2, Indiana

SILENCE SERVICE

Industrial Sound Control Inc.

45 Granby Street, Hartford 12, Conn.

2119 SO. SEPULVEDA BLVD., LOS ANGELES, CALIF.

This boiler is important to you...

For the critical, uncertain period ahead comes the modern MUND boiler with design features that promise continuous, automatic performance. Here's assurance of uniform power and trouble-free operation NOW when you need it most. You can always depend on Mund Boilers.

Write for complete information

MUND Boilers, Inc.

1600 No. Indiana St., Los Angeles 33, Calif.

For *IRON FIREMAN MFG. CO.*, Cleveland — *H. C. WEAR & ASSOCIATES*, 860 King St., Columbus, is handling the complete line throughout Franklin County, Ohio. *HUGH WEAR*, head of the company, was for many years a district sales manager for Iron Fireman.

For *EMERSON ELECTRIC MFG. CO.*, St. Louis — *HOWARD SAMPLE*, formerly assistant manager of merchandise sales, is now manager, eastern district, with headquarters in New York City.

For *TRANE CO.*, La Crosse, Wis.—*DANIEL J. NADOLSKI* is manager, Birmingham, Ala., sales office. Formerly he was with the St. Louis office.

For *CARRIER CORP.*, Syracuse—*AIR CONDITIONING EQUIPMENT CO.*, Omaha, is distributor in Nebraska and western Iowa.

For *FAGEOL HEAT MACHINE CO.*, Detroit—*N. R. ALDRICH* is handling distribution and sales in Missouri, Kansas, Iowa and Nebraska, with headquarters in Sheridan, Mo. He had been sales manager for Continental Mfg. Co., Inc., Harrisonville, Mo.

For *BRYANT HEATER DIV.*, Affiliated Gas Equipment, Inc. — *BRYANT EQUIPMENT CORP.*, 1131 Campbell Ave., West Haven, Conn., is distributor in Connecticut and in Westchester and Putnam counties, New York. *M. H. LAUNDON, JR.*, is president of the new company.

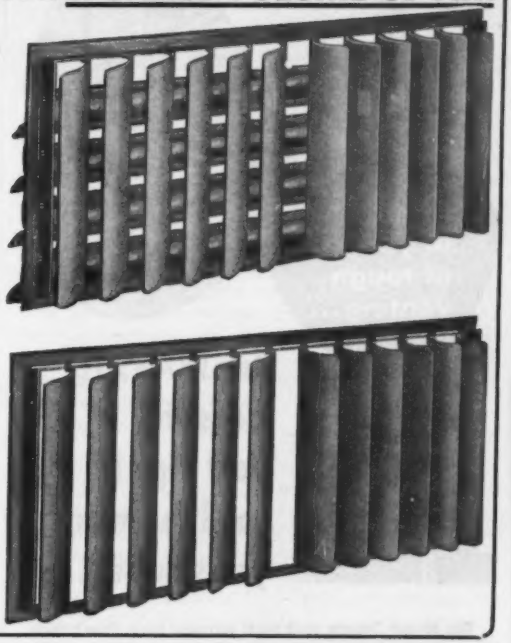
For *SERVEL, INC.*, Evansville, Ind.—*CHARLES M. HEATHMAN* is southeastern field sales representative for the electric refrigeration division. His territory includes Maryland, West Virginia, Virginia, North Carolina, South Carolina, Georgia, Alabama, Florida, and sections of Delaware, Pennsylvania, Ohio, Kentucky and Tennessee. *C. A. GRUGGEL* has been transferred to the eastern regional office in New York as an air conditioning sales representative.

For *INDUSTRIAL DIV., MINNEAPOLIS-HONEYWELL REGULATOR CO.*, Philadelphia—Six new regional sales managers: *JACK E. MacCONVILLE*, southeast, headquarters in Atlanta; *ALFRED J. McCULLOUGH*, central, headquarters in Cleveland; *HOWARD L. MARSTON*, northwest, headquarters in Minneapolis; *ROBERT L. MALLORY*, southwest, headquarters in Dallas; *ROBERT B. GRANT*, Pacific and mountain region, headquarters in Los Angeles; and *LESTER W. WILLIAMS*, Pacific northwest, headquarters in Portland. Three new branch office managers have also been named. They are *ROBERT M. WOODSIDE*, at Cleveland; *JOHN O. PAULL*, at Los Angeles; and *LEE APLIN* at San Francisco.

For *THE YOUNGSTOWN SHEET AND TUBE CO.*, Youngstown, Ohio—*DAVID W. MARTIN* is district manager in charge of the Atlanta office, succeeding the late *WILLIAM WALTON FORD*.

A-J Has The Answer:

WHEN YOU HAVE A LARGE VOLUME OF AIR TO HANDLE . .



Here's a DIFFUSER That Combines Engineering Control With Architectural Beauty!

Ideal for theaters, schools, offices and factories. Fully adjustable. Available in any size — no matter how big! Standard Finish: metallic bronze hammertone.

A-J

DOUBLE DIFFUSER

Perfect diffusion — directs air flow down and to sides. Vertical curved louvers usually divided ½ right, ½ left. However, A-J Diffusers are also available with *all* vertical louvers facing one direction.

A-J

SINGLE DIFFUSER

Available with either all *vertical* louvers or *horizontal*. Vertical louvers may be divided ½ right, ½ left to split the air stream in two directions, or all facing one direction.

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Listing Over a Thousand Types and Sizes of Grilles for Every Requirement.

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AIR YOUR VENTILATION PROBLEMS WITH PENN DYNAFANS

No doubt about it—Penn Dynafans increase employee efficiency in your customer's plants by exhausting the "hot spots." This rugged unit can be depended upon to handle the toughest ventilation problems . . .

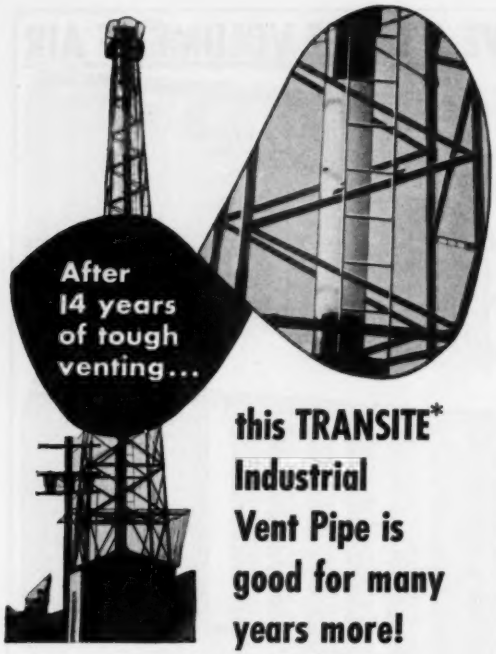
- Motors out of the air stream, safely remove dust, heat, fumes, vapors, etc.
- Economical to install and operate.
- Sizes range from 250 c.f.m. to 30,000 c.f.m.
- Pulling power is positive and units will not overload regardless of resistance.
- Units are quiet running and have a low clean silhouette.

Write for complete literature today.
Representatives and Distributors in Principal Cities.

PENN VENTILATOR CO.

PHILADELPHIA 40, PENNSYLVANIA

FOR MORE THAN 25 YEARS THE BUILDERS' ROOF TOP LINE!



this TRANSITE* Industrial Vent Pipe is good for many years more!

This 80-foot Transite stack vents corrosive gases from a trunk sewer in a large city. In excellent condition after 14 years, it has already outlasted the original metal breechings.

Typical of the long service life you can expect from Transite Pipe in solving tough venting problems, this durable asbestos-cement product successfully resists a wide variety of corrosive industrial fumes and gases and vapors which seriously affect other pipe materials in a short time.

Because Transite Industrial Vent Pipe is non-metallic and is therefore rustproof, it requires no paint or other protective treatment. Due to its unusually high chemical stability, it has substantially reduced replacement and maintenance costs in duct, vent and stack systems in plants across the country.

It is light in weight, easy to handle, easy to install, can be cut and drilled with ordinary tools. It comes in a complete range of sizes up to 36" in diameter . . . with a full line of rustproof, corrosion-resistant Transite fittings which make it adaptable to practically any job requirement.

For further details on Transite for industrial venting, write to Johns-Manville, Box 60, New York 16, N. Y. Ask for Data Sheet Series DS-336. In Canada: 199 Bay Street, Toronto 1, Ontario.

*Transite is a registered Johns-Manville trade mark

Johns-Manville TRANSITE Industrial Vent PIPE

For *UNITED STATES AIR CONDITIONING CORP.*, Minneapolis—*LAMATT AGENCY DIV., SOUTHERN HEATER CO.*, New Orleans, is representative for the complete line throughout Mississippi, most of Louisiana, and western Tennessee. The territory will be served by three offices of the agency, at 840 Baronne St., New Orleans; 2840 Arbor Hills Drive, Jackson; and 1482 Madison Ave., Memphis. *DUVAL DISTRIBUTING CORP.*, Richmond, is distributor of window type room air conditioners in Virginia. The main office is at 1221 Admiral St.

For *CONOFLOW CORP.*, Philadephia — *BRUCE GREAVES CO.*, St. Louis, is handling pneumatic control equipment in the St. Louis territory, covering eastern Missouri and southwestern Illinois.

For *THE SWARTWOUT CO.*, Cleveland — a new district sales and service office for the Power Plant and Autronic Control Divs., at 317 W. Main St., Alhambra, Calif. The office, which will service southern California, Arizona, and Clark County, Nev., will be managed by *ROGER L. GILLILAND*, development engineer with the company.

For *JOHNSON SERVICE CO.*, Milwaukee — two new branch offices: the Rochester, N.Y., office, headed by *HARVEY E. SIEBERT*, and the Great Falls, Mont., office, headed by *HUGH M. ROWE*. *NORMAN A. BORTZ* has been transferred from New Orleans to the Jackson, Miss., branch.

For *ACME INDUSTRIES INC.*, Jackson, Mich. — *MUSSUN EQUIPMENT CO.*, 915 Hanna Bldg., Cleveland, is representative in northern Ohio, to handle all products of the contractor and "Flow-Cold" sales divisions.

For *PATTERSON-KELLEY CO., INC.*, East Stroudsburg, Pa. — *THE HESTER-BRADLEY CO.*, St. Louis, is representative in eastern Missouri and southern Illinois for the hot water storage heater and heat exchanger division.

For *THE WHITE-RODGERS ELECTRIC CO.*, St. Louis — two new enlarged regional branch offices. The Detroit branch, at 16590 Wyoming, is headed by *CHARLES O'BRIEN*, assisted by *DON ROBINSON*. The New York branch, at 35-14 Crescent St., Long Island City, is headed by *ARNOLD E. PETERSEN*, assisted by *JACK WEIGERT*, *FRANK CRAWFORD*, and *ED HARTNETT*.

For *MIRACLE ADHESIVES CORP.*, New York — *M. E. VOGEL* is now western sales manager, with headquarters in Los Angeles.

For *METALBESTOS DIV., WILLIAM WALLACE CO.*, Belmont, Calif.—*REX FALKNER* has been assigned to the sales staff of the Dallas office. Previously, he was sales manager for a heating supply firm in Dallas.

For *ALLOY STEEL PRODUCTS CO., INC.*, Linden, N.J. — *E. J. LICKWAR* is sales representative in the Pitts-

burgh area, replacing *HERBERT V. EVANS, JR.*, recently made district manager at Wilmington, Del.

For *PENN CONTROLS, INC.*, Goshen, Ind. — *WILLIAM L. BEALE*, head of *AUTOMATIC EQUIPMENT CO.*, is district sales representative in Albuquerque, N. Mex.

For *RADIATOR SPECIALTY CO.*, Charlotte, N.C. — *HENRY DOLING* will handle "Solder Seal" specialties in the Albany district.

For *PENN METAL CO., INC.*, — new offices at 1025 Connecticut Ave. N.W., Washington, D.C., covering the District of Columbia, Maryland, most of Virginia, and part of West Virginia. *CECIL R. COOLEY* is manager.

For *TINNERMAN PRODUCTS, INC.*, Cleveland — *CHRIS RINGHAVER* is district sales manager of the Chicago office. Succeeding him as manager, western New York district, at Rochester, is *THOMAS M. LANDFEAR*. *HERMAN H. WELLAND* is now manager, Cincinnati office, succeeding *J. G. McLAUGHLIN*, who has resigned to establish his own firm.

For *JOSEPH DIXON CRUCIBLE CO.*, Jersey City, N.J. — *JOHN B. VAN WHY* is representative in the Connecticut, Rhode Island, and western Massachusetts area, to handle paints and lubricants.

For *QUAKER RUBBER CORP.*, Div., H.K. Porter Co., Pittsburgh — a branch warehouse and sales office at 430 S. Mill St., Lockland 15, Cincinnati. It is supervised by *W. W. HUTCHINSON*.

For *PERFEX CONTROLS LTD.* — *MALBOURNE CLARKE* now heads sales in eastern and northern Ontario, with headquarters in the Toronto office.

For *A. O. SMITH CORP.*, Milwaukee—*M. L. LAVORGNA, INC.*, Milwaukee, is water heater and heating products distributor for southeastern Wisconsin.

For *OWENS-CORNING FIBERGLAS CORP.*, Toledo—establishment, in Cincinnati, of the *FIBERGLAS CONTRACTING AND SUPPLY CO. OF THE OHIO VALLEY*, with offices and warehouse at 4610 Smith Rd. It will serve as distributor and applicator of "Fiberglas" industrial products for 36 counties in Ohio, Kentucky and Indiana, and will be directed by *LEE R. REEDER*, vice president and general manager.

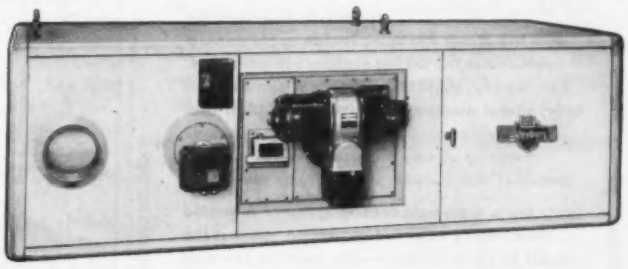
INDUSTRIAL CONSERVATION, a guide to conservation engineering practices, has been issued by the Defense Production Administration as part of its in-plant conservation program. Techniques are suggested for recovering important industrial minerals and other materials.

For further information on this booklet and the program, write Conservation Div., Defense Production Administration, Washington 25, D.C.

Sell Comfort...

SELL MORE USABLE FLOOR SPACE with the

Waterbury



Oil-Fired, Forced Warm Air SUSPENDED FURNACE

4 Sizes: 84,000 to 168,000 B.T.U. Output

A special unit is needed in situations where floor space is at a premium. This need has been met very successfully in the latest addition to the Waterbury line.

Commercial buildings, industrial plants, and certain types of homes require a warm air heating plant with the qualities of the Waterbury suspended furnace. A real space saver, it can be suspended in a crawl space under the floor, from the basement ceiling, in the attic, or in any portion of the building where more space is readily available at ceiling level than on the floor.

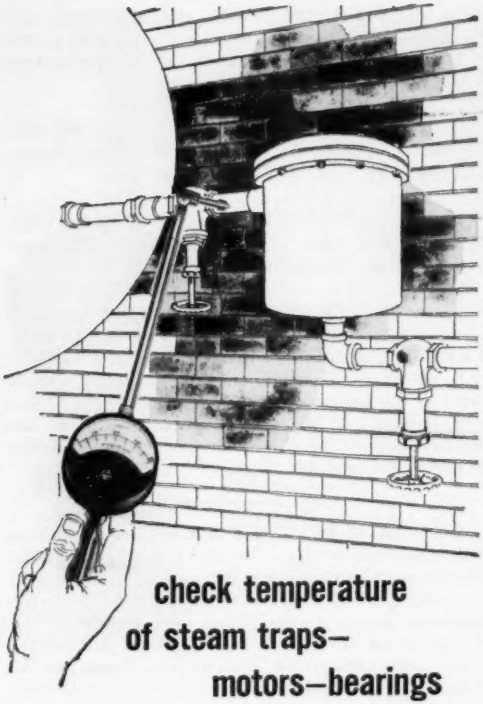
A "package" unit, assembled at the factory, the Waterbury suspended furnace has all parts accessible from the front, for easy inspection, cleaning and servicing. Air filters and a large capacity blower are standard equipment. This compact unit deserves serious consideration by owners, builders and men concerned with the maintenance of service stations and other commercial or industrial buildings.

Waterbury manufactures a complete line of furnaces and winter air conditioners, with a unit for every size home and every type of fuel.

The Waterman-Waterbury Co.

OVER 45 YEARS OF WARM AIR HEATING

1152 Jackson St., N.E., Minneapolis 13, Minn.



check temperature of steam traps— motors—bearings

. . . quickly and accurately with the Alnor Pyrocon, the portable contact pyrometer for taking surface temperatures. This handy, portable instrument can be your most useful maintenance and installation tool . . . it provides accurate temperature readings instantly of any surface (metallic or non-metallic), flat, curved, stationary or revolving.

It's a well-balanced instrument mounted in a sturdy case for protection against the usual hazards of on-the-job service. Jeweled movement is also heavy-duty, shock-resistant type that will withstand hard and continuous use . . . performing with laboratory accuracy.

A wide selection of thermocouples and extension arms assures its adaptation to your needs. Eight standard F. scale ranges are available up to 1200°F. Send for complete details contained in Bulletin 4257. Illinois Testing Laboratories, Inc., Rm. 513 420 N. LaSalle St., Chicago 10, Ill.

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PRECISION INSTRUMENTS FOR EVERY INDUSTRY

NEW BOOKS & REPORTS

Welding Piping in Marine Construction

The recent trend to greater pressures and temperatures for marine piping has led to the use of alloy steel piping. This has required revision of existing rules and regulations governing the welding of piping, which had been intended for carbon steel only. The American Welding Society Marine Committee has just completed *Rules for Welding Piping in Marine Construction — Ferritic Alloy Steels*, which contains the requirements for joint design, electrodes, welding procedures, postheat, preheat, stress relief and testing of welded ferritic alloy steel pipe joints. Included is a radiographic standard for evaluating weld quality, as well as non-destructive test requirements.

Copies of this 12 page booklet are available from the American Welding Society, 33 W. 39th St., New York 18, at 50 cents each.

Tubular Exchanger Standards

The third edition of *Standards of Tubular Exchanger Manufacturers Association* has been released for general distribution. The material in the 1949 edition has been revised and expanded, with additional mechanical and thermal standards which conform with current findings of the association's technical committee. In addition, two new sections have been added, one giving the mechanical standards for alloy steel heat exchangers, and the other containing general information valuable to designers, fabricators and users of heat exchangers. The edition also incorporates, as did previous ones, standard nomenclature, material specifications, thermal standards, maintenance suggestions, and mechanical standards for carbon steel and nonferrous alloy construction, and Class R and Class C heat exchangers.

This 162 page volume is available from the association, 53 Park Place, New York 7, at $5.50 a copy for non-members.

Metals at Low Temperatures

Much equipment operates at low temperatures, and the consequent embrittlement of materials, accompanied by failures, is of concern to designers, manufacturers and users. The subject of metals at low temperatures continues to increase in importance with the growth of the refrigeration industry and the expanding demand for the liquefaction, transportation, and storage of many gases.

Mechanical Properties of Metals at Low Temperatures, National Bureau of Standards Circular 520, presents the results of studies conducted in industry and government. The papers were initially presented at the symposium on the subject held at the bureau's meeting in May, 1951. They cover recent European work in the field; manufacture of steels, development and application of chromium-copper-nickel steel, and application of metals in aircraft for low temperature service; tensile properties of copper, nickel, etc., and properties of austentic stainless steels; dimensional effects in fracture; and other topics.

This 206 page publication may be obtained from the Government Printing Office, Washington 25, D.C., at $1.50 a copy.

Copper and Its Alloys

The latest edition (February 1952) of *ASTM Standards on Copper and Copper Alloys* brings together 114 specifications and test methods covering plate, sheet, rolled bar and strip; rod, bar and shapes; pipe and tubes; wire; sand and die castings; arc welding electrodes and brazing solder, etc. A group of specifications cover non-ferrous metals such as slab zinc, and test methods are included for expansion, mercurous nitrate, tension, hardness, sampling, etc.

This 520 page book is available from the American Society for Testing Materials, 1916 Race St., Philadelphia 3, at $4.75 per copy in heavy paper cover, $5.40 with cloth cover.

Controllers for Electric Motors

The second edition of *Controllers for Electric Motors*, by H. D. James and L. E. Markle, includes much new material. There are new chapters on such recent developments as the magnetic amplifier, the dynamo electric amplifier, magnetic clutches, a-c and d-c crane control, and remote and supervisory control. In addition, this volume retains the information about design, application, operation, and maintenance of industrial controllers which appeared in the first edition.

This 418 page book is available from the publisher, McGraw-Hill Book Co., 330 W. 42nd St., N.Y., at $7.00 a copy.

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GRILLES
Many designs for all purposes—air conditioning, ventilating, radiator enclosure and concealment. Almost any sizes in steel, aluminum, brass or bronze. In selecting grilles, you will find Auer Grille Catalog "G" useful. It gives complete grille data, shows all Auer designs, with dimensions, opening sizes, and full scale details. Sent on request. Order Auer Grilles by name and number.
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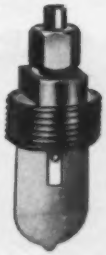
It isn't every day that we hire a Sales Manager hoping he becomes a Vice President, Director or both within a few years. But that's our offer. We want a Sales Manager who will supervise sales and advertising *now;* who can plan on having a voice in company business and financial matters *soon;* and who will be encouraged to become an executive of a 50-year old, nationally known Toronto heating equipment manufacturer. If you're between 35-45 and have hard goods experience here is your opportunity. Write your qualifications and salary requirements to BOX 970 A, Heating, Piping & Air Conditioning, 6 No. Michigan Ave., Chicago 2, Ill.

New! MAID-O'-MIST BALANCING VALVE ADAPTER UNITS

Make any copper, bronze or cast iron tee a balancing valve!

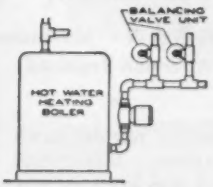
No. 14 Balancing Valve Adapter Unit for ⅜", ½", ¾", 1" nominal copper or bronze tees.



No. 15 Balancing Valve Adapter Unit for ½", ¾", 1" or 1¼" cast iron tees.

Eliminate costly stocks of square head cocks and balancing valves. These new units are quickly soldered, sweat-fitted or threaded into tees. No restriction of hot water flow except for balancing needs.

JUST A FEW OF THEIR MANY USES



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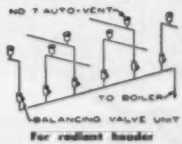

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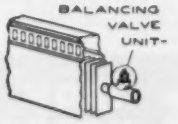
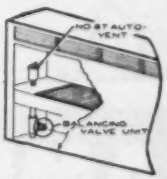


For baseboard radiators



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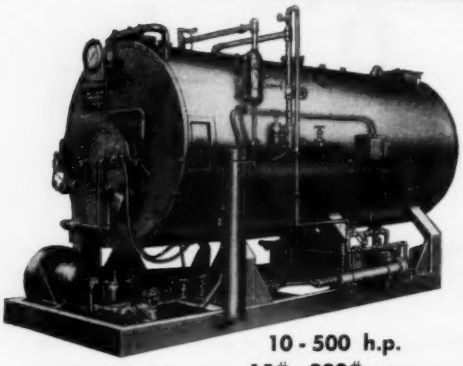

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For your convenience in obtaining copies of these bulletins, see coupon on page 181. If you write direct to the manufacturer, describe fully what you want, as the number given first in each item is for use only when sending requests to Heating, Piping & Air Conditioning.

Acid-Proof Materials

HPAC 101—Three descriptive technical bulletins treat acid-proof materials and construction — Aqua-Therm, Inc., 37-41 N. Torrence St., Dayton 1. Bulletin 139 covers "Eonite" pipe and fittings, made of furan resin material reinforced with laminations of chemical glass fabric cloth, for handling mineral acids, alkalis, and organic solvents. Bulletin 160 discusses acid-proof construction of process tanks, vessels, towers, etc. Bulletin 190 covers a lacquer coating to protect surfaces from the corrosion effects of gases, vapors, mists and liquids.

Air Conditioning Smoke Alarms

HPAC 102—Four-page bulletin describes three models of a smoke control alarm designed to shut off fans and cut off the air supply at the first sign of smoke within ducts — Ess Instrument Co., 96 S. Washington Ave., Bergenfield, N. J. It is recommended by the manufacturer for use in theaters and other large buildings.

Air Purification and Odor Removal

HPAC 103—Bulletin describes food storage applications of equipment using activated coconut-shell carbon for purifying the air and preventing contamination by odors — Pur Air Div., American Solvent Recovery Corp., 8th and Cassady Aves., Columbus 3.

Alarm Silencing Relay

HPAC 104—Bulletin 8501 treats an alarm silencing relay used in electric control circuits — Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Station 40, Wayne and Windrim Aves., Philadelphia 44. It supplies the means for silencing and resetting the alarm.

Boiler Firing with Oil or Gas

HPAC 105—Bulletin B/9 describes and illustrates the "Combinetic" unit which combines the "Kinetic" gas burner and a pressure atomizing oil burner — The Webster Engineering Co., P. O. Box 2168, Tulsa 1. Specifications are given and a typical installation is shown.

Breakaway Coupling

HPAC 106—Folder describes a breakaway coupling carrying fluid or oxygen lines, plus electrical lines, in one envelope — E. B. Wiggins Oil Tool Co., Inc., 3424 E. Olympic Blvd., Los Angeles 23. It has been pressure tested to 750 psi, and uses any standard insert.

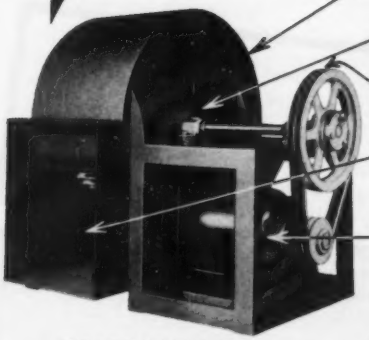
Check Valves

HPAC 107—Bulletin WS-1 (two pages) offers information on hydraulic double cushioned check valves — Golden-Anderson Valve Specialty Co., 2104 Keenan Bldg., Pittsburgh 22. Drawings show all parts, and application, construction, and dimension details are given.

Check THESE SPECIAL FEATURES

see why Peerless offers you

"THE SMOOTHEST PERFORMERS ON THE MARKET"



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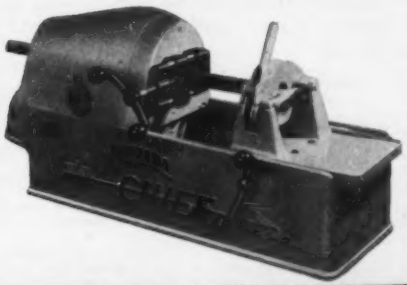

PIPE SIZE	½"	1"	1½"	2"
THREADING TIME	11 sec.	17 sec.	20 sec.	23 sec.
REAMING TIME	YOU REAM WHILE YOU CUT			
CUTTING TIME	5 sec.	5 sec.	7 sec.	9 sec.
TOTAL TIME	16 sec.	22 sec.	27 sec.	32 sec.

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CHIEF POWER DRIVEN PIPE AND BOLT THREADER DOES IT FASTER...BETTER!

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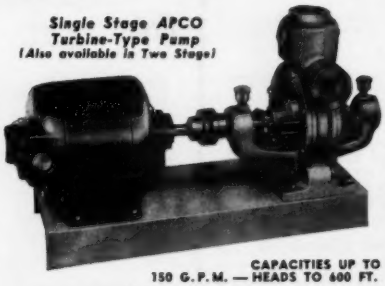
Single Stage APCO Turbine-Type Pump
(Also available in Two Stage)



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- REPLACEABLE COVER PLATES

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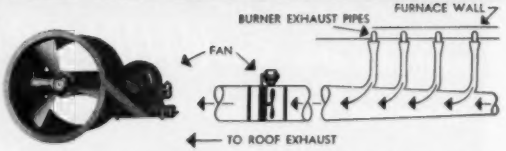
SOLUTION—A unique exhaust system using 9 Propellair Fans with total CFM of 70,607, requiring only 29 H.P.



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Cooling Coils

HPAC 108—Bulletin 396A covers a complete line of cooling coils for direct expansion refrigerants, circulating water and brine — Marlo Coil Co., 6135 Manchester Rd., St. Louis 10. It gives design, construction and dimensional data, plus psychrometric charts, and includes the company's new charts and rule for use in coil selection.

Dehumidifying Equipment

HPAC 109—Bulletin 222 (32 pages) describes installations of dehumidifying equipment designed to solve production, handling and storage problems in industry — Pittsburgh Lectrodryer Corp., P. O. Box 1766, Pittsburgh 30.

Diaphragm Control Valves

HPAC 110—Revised edition of the diaphragm control valve section of the "Climax" control equipment catalog covers new or completely redesigned items, such as the Type 87 valve with bellows sealed stem, the Type 115 expanded outlet valve and the Type 1486 three way valve — Black Sivalls & Bryson, Inc., 7500 E. 12th St., Kansas City 3, Mo.

Electric Control Thermometers

HPAC 111—Catalog 6482 treats recording and indicating circular case electric control industrial thermometers used for temperature control on drying ovens, plating tanks, etc. — Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Station 40, Wayne and Windrim Aves., Philadelphia 44.

Electronic Flow Meter

HPAC 112—Instrumentation Data Sheet 10.3-5 describes the "Potter-Brown" flow meter, designed for measurement of fluids over an extremely wide range of temperatures and pressures with an accuracy of 0.5 percent — Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Station 213, Wayne and Windrim Aves., Philadelphia 44.

Equipment for Purifying Air and Gas Lines

HPAC 113—Two revised bulletins pertain to "Liqui-Jector" equipment for the removal of water, water-oil emulsions and dirt from compressed air and gas lines — Selas Corp. of America, Erie Ave. and D St., Philadelphia 34. The equipment operates without moving parts, using ceramic filter candles to clean air or gas. One series has a range of 10 to 75 cfm, the other, 100 to 500 cfm.

Evaporators

HPAC 114—Manual contains simplified charts and tables intended to make evaporator selection easier and to reduce designing time — Bell & Gossett Co., Morton Grove, Ill.

Expansion Joints

HPAC 115—Catalog CMH-119R presents the new "Flexon" line of expansion joints designed to accommodate increased expansion with fewer corrugations — Flexonics Corp., 1396 South Third Ave., Maywood, Ill. Specifications and installation data are given for joints for low, high, and extremely high pressures.

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Humidity conditioning saves Haloid Co. $40,000.00 yearly!

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The Webster Kinetic consists of a multiplicity of full venturi mixers with flame retention nozzles. These are assembled in a metal casing complete with pilot and louvre. It may be used with natural, mixed or liquefied petroleum gases. Standby oil burners may be used when desired. As a multiple head assembly it is available in 25 standard sizes of from 4 heads to 48 heads, and can be supplied in any size or shape. Natural gas input ratings from 560,000 Btu/hr to 6,720,000 Btu/hr at 4" wc.

For complete information request Series B8 Bulletins.

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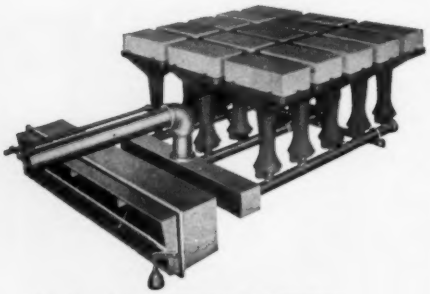
WEBSTER
SERIES F 600 BURNER

For Low Pressure Gas



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INTERCHANGEABLE PORTS
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NO COMBUSTION CHAMBER required
Will NOT VIBRATE
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ANY SHAPE and SIZE
INTEGRALLY MOUNTED pilots

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Flexible Coupling

HPAC 116—Folder gives details on construction features of a flexible coupling designed to withstand pressures in excess of 375 psi, and temperatures from −65 to 160 F on fuel and oil lines — E. B. Wiggins Oil Tool Co., Inc., 3424 E. Olympic Blvd., Los Angeles 23. It is light weight and can be misaligned as much as three degrees without leaking, the manufacturer states.

Flow Rate Control

HPAC 117—Bulletin 521 covers a line of direct acting flow rate regulators — W. A. Kates Co., 430 Waukegan Rd., Deerfield, Ill. They are designed for accurate, positive control of flow despite pressure fluctuations.

Equipment for Heating, Ventilating, etc.

HPAC 118—Estimating catalog for Spring and Summer, 1952, is a pricing guide giving selection data on fans, blowers, compressors, accessories, fittings, pumps, coils, condensers, valves, motors, v belt drives, grilles and registers, air conditioners, chillers, etc. — M. Blazer & Son, 173 Market St., Passaic, N. J.

Hose Nipples

HPAC 119—Data sheet describes "Le-Hi" Series 650 Type SC non-porous steel combination hose nipples — Hose Accessories Co., 2700 N. 17th St., Philadelphia 32. They are made of steel tubing, in one piece, with accurate hose shank diameters and inside surface clean and scale free, the manufacturer states.

Index of Literature on Instruments

HPAC 120—Bulletin 100-A is an index of technical literature available from the company's Industrial Div., consisting of a numerical listing and alphabetical cross index for specification sheets, data sheets, etc. — Minneapolis-Honeywell Regulator Co., Brown Instrument Div., Station 40, Wayne and Windrim Aves., Philadelphia 44.

Indicating Potentiometers

HPAC 121—Specification Sheet 177 describes and illustrates the "Electronik" precision indicator for both single and multi-point indication of variables, as well as the extended range indicator — Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Station 40, Wayne and Windrim Aves., Philadelphia 44. It shows how the indicator, combined with the new console-type operator's desk and banks of switches, permits the operator to review and log many variable readings.

Instrument Sensing Units and Accessories

HPAC 122—Bulletin TC-9, the 1952 data book and catalog (42 pages), contains application recommendations, prices, and other information on thermocouples, radiation detectors, resistance bulbs and other accessories for indicating, controlling and recording instruments — Wheelco Instruments Div., Barber-Colman Co., 1228 Rock St., Rockford, Ill.

Insulation and Finishing Cement

HPAC 123—Folder describes "Mono-Block" one block insulation and "Powerhouse" finishing cement that insu-

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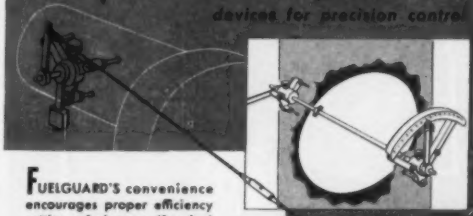
Fuelguard DAMPER REGULATOR

with fuel-saving, safe, sensitive devices for precision control



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lates — Baldwin-Hill Co., 500 Breunig Ave., Trenton 2, N. J. The insulation is black mineral wool felted into block form with an inorganic clay binder.

Glossary of Castings Terms

HPAC 124—36 page glossary explains over 150 technical terms employed by suppliers and users of ferrous and non-ferrous castings — The International Nickel Co., Inc., Dept. EZ, 67 Wall St., New York 5.

Mask-Washing and Spray Painting Machines

HPAC 125—Data sheet covers an automatic machine for cleaning spray painting masks, and spray painting machines for a variety of small parts which have detail painting or masking areas — Conforming Matrix Corp., Factories Bldg., Toledo 2.

Metallizing for Corrosion Protection

HPAC 126—*Metco News*, Vol. 6, No. 2, describes metallizing applications, among them the use of a zinc and vinyl coating for protecting large underground conduits — Metallizing Engineering Co., Inc., 38-14 30th St., Long Island City 1, N. Y.

Moisture Absorbent

HPAC 127—Bulletin L-5377 is a catalog sheet describing "Hum-I-Dri" moisture absorbent for industrial and residential use — Speco Inc., 7308 Associate Ave., Cleveland 9. It is designed to remove from the air up to ten times its weight in moisture.

Pilots and Controllers

HPAC 128—Revised edition of the pilots and controllers section of the company's "Climax" control equipment catalog shows complete lines of time cycle, pressure, and manual remote controllers; and vacuum and safety shutoff pilots — Black, Sivalls & Bryson, Inc., 7500 E. 12th St., Kansas City 3, Mo. A new pressure controller using bellows for low pressures, and a new safety shutoff pilot are described.

Powder Actuated Fasteners and Accessories

HPAC 129—Form No. 68 (eight pages) describes and illustrates powder actuated fastening tools, and drive pins, threaded studs, fastening charges, fixtures, etc. — Ramset Fasteners, Inc., 12117 Berea Rd., Cleveland 11.

Pressure Gages

HPAC 130—Specification Sheet 708 (four pages) gives information on indicating and recording pressure gages, and includes construction and engineering details — Minneapolis-Honeywell Regulator Co., Industrial Div., Station 40, Wayne and Windrim Aves., Philadelphia 44. Specification Sheet 709 covers these gages with "Electr-O-Vane" control, and Sheet 710 describes them with pneumatic control.

Pumps

HPAC 131—Commercial Catalog C-52, compiled especially for use by dealers in water systems and miscellaneous pumps and accessories, gives details of pump construction, views of complete pumps and water systems, selection tables, tables of water requirements for public buildings, pipe friction tables, wiring diagrams, etc. — The Deming Co., 14 Aetna St., Salem, Ohio.

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—the domestic engineering contractor's answer to the problem of:

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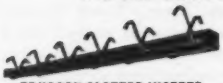
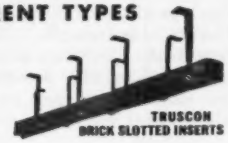


TRUSCON SLOTTED INSERTS



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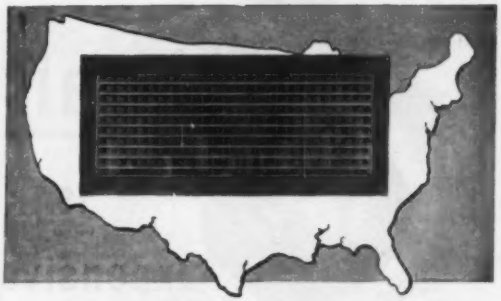

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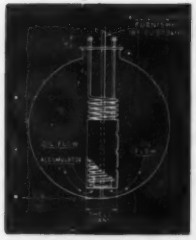

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HPAC 132—Catalog 15 (64 pages) treats the complete line of "Vitrohm" power type wire-wound resistors — Ward Leonard Electric Co., 24 South St., Mt. Vernon, N. Y. Listed are seven stock type resistors and a variety of made-to-order types. Resistor ratings range from 5 to 550 watts and resistance values listed are from 0.04 ohm to 1.75 megohms. Selection and application data is presented, and full details are given on terminals, mountings, and enclosures.

Rotary Burners

HPAC 133—Catalog (eight pages) covers rotary burners designed for commercial and industrial use with any type of oil, as well as for operation in combination with any type of commercially available gas — Superior Combustion Industries, Inc., Times Tower, Times Square, New York. Nine sizes provide a capacity range from 5 to 167 gph of oil. Features of construction, operation, and standard equipment are described, and specifications are given.

Safety Valves and Controls for Hot Water Systems

HPAC 134—16 page booklet, designed to help those concerned with domestic hot water supply and hot water space heating, lists and answers 52 typical questions about safety practice in selection, installation, and maintenance of safety valves and controls — Watts Regulator Co., 10 Embankment St., Lawrence, Mass.

Space Heaters

HPAC 135—Revised edition of bulletin 523-B (12 pages) on "Counterflo" forced air space heaters includes information on use of the heaters for eight applications besides space heating — Dravo Corp., Machinery Div., Neville Island, Pittsburgh 25. These uses include integration with air conditioning systems, functional heating, process drying, temporary heating, medium temperature drying, etc.

Steam Generator

HPAC 136—Bulletin offers information on the Series 9100 "Scotch" type packaged, automatic steam generator for low pressure heating and process services — Johnston Brothers, Inc., Ferrysburg, Mich. This is a two-pass, natural draft, waterback type boiler. Specifications and dimension data are given.

Steam Traps

HPAC 137—Catalog J (44 pages), superseding Catalog H, is a manual of recommended trapping practice, and includes a trap catalog section, a handbook explaining calculation of condensate loads and trap selection, and a maintenance section explaining installation, repair, etc. — Armstrong Machine Works, Three Rivers, Mich. The catalog section offers physical data and list prices on cast semi-steel and forged steel inverted bucket steam traps, compound steam traps, and ball float air and air relief traps.

Tachometers for Speed Measuring Applications

HPAC 138—Data sheet No. 42P (revised) describes tachometers for speed measuring applications where a

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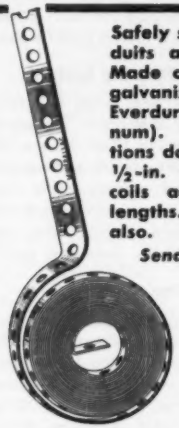

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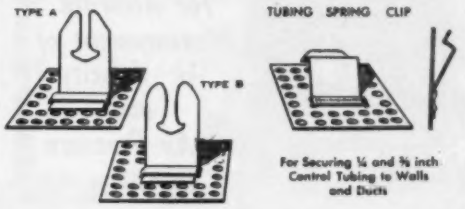

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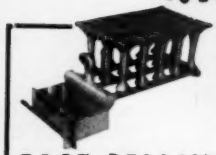

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wide range of speed measurement is desired in a continuously indicating switchboard instrument — Metron Instrument Co., 432 Lincoln St., Denver 9. Applications include turbine tests, process control, etc.

Tank Lining

HPAC 139—Folder describes elastic porcelain lining for protecting water tanks against rust, corrosion, and leaks — Porce-Lin Tank Lining Co., 456 E. Milwaukee Ave., Detroit 2. The lining expands and contracts at the same rate as iron and steel, and is self-curing under water.

Temperature Control for Vapor Heating Systems

HPAC 140—Bulletin covers the new Type R-1 temperature control for vapor heating systems — Barnes & Jones, Inc., 128 Brookside Ave., Jamaica Plain, Boston 36. It compensates for all factors including inside and outside temperatures, and for the amount of vacuum in the line. It also has set back and zone features. Described are the operating principle, the adjustable orifice valve, the thermal adjuster, the control panel, the governor, etc.

Temperature Indicator-Controller

HPAC 141—Bulletin 1052 covers "Pulse Pyr-O-Vane" indicating millivoltmeter controller, which provides time-proportioning control action and is designed for temperature control of electrically heated or fuel fired processes — Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Station 40, Wayne and Windrim Aves., Philadelphia 44.

Thermocouple Assemblies and Parts

HPAC 142—Catalog EN-S2 (44 pages) offers information on available couples and couple assemblies for general applications, and includes an expanded section on special couples for the plant and laboratory — Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia 44.

Thermostatic Bimetal

HPAC 143—32 page booklet describes uses of bimetal as the actuating element in temperature responsive devices, and gives condensed engineering data for bimetal element design and selection — W. M. Chace Co., 1656 Beard Ave., Detroit 9.

Tubing and Shapes

HPAC 144—Four page brochure describes copper, brass and aluminum tubing, bi-metal seamless tubing, and other special types; and non-ferrous and bi-metal shapes — Fromson Orban Co., Inc., 205 E. 42nd St., New York 17.

Tubing for Production of Parts

HPAC 145—Bulletin TB 339 discusses the use of seamless cold-drawn carbon steel mechanical tubing in the production of hollow precision parts — Tubular Products Div., The Babcock & Wilcox Co., Beaver Falls, Pa. Tables of tolerances and mechanical properties are given.

Water Softeners

HPAC 146—Booklet 2239B discusses use of water softeners in reducing operating costs in restaurants — The Permutit Co., 330 W. 42nd St., New York 36. It describes the company's automatic water softener, which is attached to the incoming supply line.

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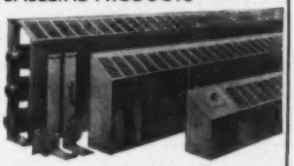

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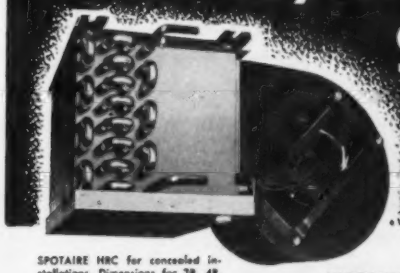

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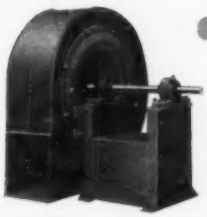

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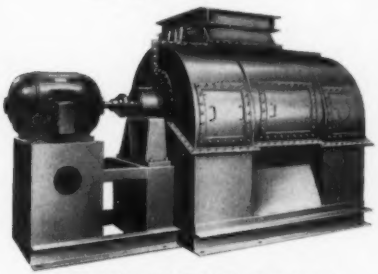

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HEADQUARTERS FOR AIR HANDLING AND CONDITIONING EQUIPMENT

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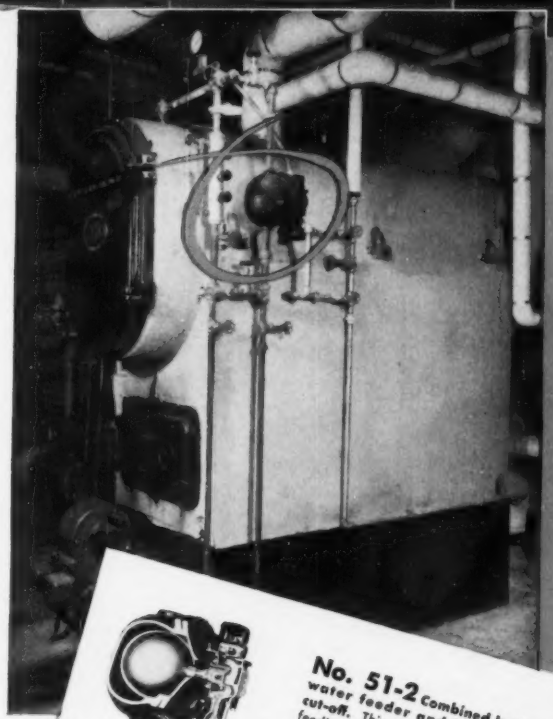
Yes, STEAM HEATING IS STILL GOING STRONG!

Rose Mary Home, Cleveland, Ohio

Architect:
William and Thomas Koehl

Heating Contractor:
Gorman Lavelle Plumbing & Heating Co.

(Photo at right shows Rose Mary Home Boiler Room)



IT'S a pleasure to see that faithful old friend, steam heating, still going strong in new buildings. There are lots of conditions that steam ideally fulfills . . . and one of the many examples of this is pictured here; the heating system in the newly completed Rose Mary Home at Cleveland.

In this modern building heat is supplied by a Pacific High Firebox Boiler serving a two-pipe steam system with vacuum return. The distribution system comprises about 100 convectors which are equipped with orifice radiator valves. Temperature regulation is provided by zone control valves.

That McDonnell No. 51-2 Feeder-Cut-off Combination is the completing touch to a workmanlike job. It stands there as a reminder of the importance of always making an investment in safety . . . and if there is any one place in which safety is more important than any other, it is in schools and institutions!

Most new boilers going into school and institutional buildings have McDonnell controls . . . but what about the old buildings? Suggesting McDonnell controls for school boilers that do not have them is no less than a duty. The profit you make is your reward for a good deed!

McDONNELL & MILLER, INC.
3500 N. Spaulding Ave., Chicago 18, Ill.

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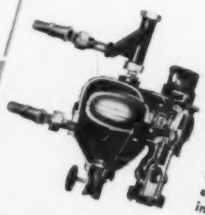
No. 51-2 Combined boiler water feeder and low water cut-off. This type has the water feeding capacity needed for larger boilers having more than 5000 sq. ft. capacity and is therefore the type used in Rose Mary home and for most of the larger low pressure boilers found in buildings of this class.



No. 47-2 Combined boiler water feeder and low water cut-off. This is the type for the large group of smaller low pressure heating boilers with capacities less than 5000 sq. ft.

Both the No. 51-2 and 47-2 are available without low water cut-off switch for hand fired boilers. There is a type of McDonnell Water Level control for every type and size of boiler operating at any pressure up to 150 psi. Ask for up-to-the-minute facts.

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